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Investigations on the impacts of urban aerosol release and heat island effect on downwind precipitation in high latitudes

by

- Nicole Mölders
- Mark Olson

Summary The 3D Penn State University (PSU)/National Center for Atmospheric Research (NCAR) mesoscale meteorological model version 5.0 (MM5) served to examine the urban effects (release of heat, moisture, aerosols, sealing) on wintertime precipitation in high-latitudes. MM5 was run with three interacting domains over Alaska with Fairbanks as a test city. Statistical analysis using an unreplicated 2 factorial design was applied to detect interaction as well as significance of the individual contributions of the urban effects. The results substantiate that the release of aerosols led to a decrease in downwind precipitation, while it increased the total accumulated precipitation for the innermost domain. The results support the hypothesis that the discrepancies found between observed precipitation trends and those simulated by General Circulation Models (GCM) may be caused by the coarse resolution of these models. 4 more ▾

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... UhCm, respecitively. Note the different scaling of precipitation differences. 7 Berry, E.X., 1968. **Modification of the warm rain process**. Preprints 1st National Conf. Weather Modification, Albany, 81-88. Chen, F., and J. Dudhia, 2001. C...

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Soot microphysical effects on liquid clouds, a multi-model investigation

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- T. Iversen

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...t-range forecast of the meteorological fields. Int. Radiational Symp., Tallinn, 9-15 August, p. 11. **Berry, E. X**. and Reinhard, R. L. (1974) An analysis of cloud drop growth by collection-Part 1. Double distribut...

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Air density of the Permian atmosphere: Constraints from lithified raindrop imprints

by

- Christian Brandes

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The Route to Raindrop Formation in a Shallow Cumulus Cloud Simulated by a Lagrangian Cloud Model

by

- Yign Noh

The mechanism of raindrop formation in a shallow cumulus cloud is investigated using a Lagrangian cloud model (LCM). The analysis is focused on how and under which conditions a cloud droplet grows to a raindrop by tracking the history of individual Lagrangian droplets. It is found that the rapid collisional growth, leading to raindrop formation, is triggered when single droplets with a radius of 20 μm appear in the region near the cloud top, characterized by large liquid water content, strong turbulence, large mean droplet size, broad drop size distribution (DSD), and high supersaturations. Raindrop formation easily occurs when turbulence-induced collision enhancement (TICE) is considered, with or without any extra broadening of the DSD by another mechanism (such as entrainment and mixing). In contrast, when TICE is not considered, raindrop formation is severely delayed if no other broadening mechanism is active. The reason for the difference is clarified by the additional analysis ...
more ▾

A Cloud Microphysics Parameterization for Shallow Cumulus Clouds Based on Lagrangian Cloud Model Simulations

by

- Yign Noh

Cloud microphysics parameterizations for shallow cumulus clouds are analyzed based on Lagrangian cloud model (LCM) data, focusing on autoconversion and accretion. The autoconversion and accretion rates, A and C, respectively, are calculated directly by capturing the moment of the conversion of individual Lagrangian droplets from cloud droplets to

raindrops, and it results in the reproduction of the formulas of A and C for the first time. Comparison with various parameterizations reveals the closest agreement with Tripoli and Cotton, such as [Formula: see text] and [Formula: see text], where [Formula: see text] and [Formula: see text] are the mixing ratio and the number concentration of cloud droplets, [Formula: see text] is the mixing ratio of raindrops, [Formula: see text] is the threshold volume radius, and H is the Heaviside function. Furthermore, it is found that [Formula: see text] increases linearly with the dissipation rate [Formula: see text] and the standard deviation of ra... more ▾

...on with parameterizations. Beitr. Phys. Atmos., 59, 66-84. Berry, E. X., and R. L. Reinhardt, 1974: **An analysis of cloud drop growth by collection. Part II. Single initial distributions**. J. Atmos. Sci., 31, 1825-1831, https://doi.org/10.1175/1520-0469(1974)031,1825:AAOCDG.2.0.CO;2. C...

Understanding aerosol–cloud interactions through modelling the development of orographic cumulus congestus during IPHEx

by

- Ana Barros

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Utilization of spectral bin microphysics and bulk parameterization schemes to simulate the cloud structure and precipitation in a mesoscale rain event

by

- Alexander Khain

.... P. Frank, and K. M. Longlo (2004), Smoking rain clouds over the Amazon, Science, 303, 1337 -1342. **Berry, E. X**., and R. J. Reinhardt (1974), An analysis of cloud drop growth by collection: Part 1. Double distri...

Spectral (Bin) Microphysics Coupled with a Mesoscale Model (MM5). Part II: Simulation of a CaPE Rain Event with a Squall Line

by

- Alexander Khain

Spectral (bin) microphysics (SBM) has been implemented into the three-dimensional fifth-generation Pennsylvania State University–NCAR Mesoscale Model (MM5). The new model was used to simulate a squall line that developed over Florida on 27 July 1991. It is shown that SBM reproduces precipitation rate, rain amounts, and location, radar reflectivity, and cloud structure much better than bulk parameterizations currently implemented in MM5. Sensitivity tests show the importance of (i) raindrop breakup, (ii) in-cloud turbulence, (iii) different aerosol concentrations, and (iv) inclusion of scavenging of aerosols. Breakup decreases average and maximum rainfall. In-cloud turbulence enhances particle drop collision rates and increases rain rates. A “continental” aerosol concentration produces a much larger maximum rainfall rate versus that obtained with “maritime” aerosol concentration. At the same time accumulated rain is larger with maritime aerosol concentration. The scavenging of aeroso...
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JOYCE: Jülich Observatory for Cloud Evolution

by

- Jan Schween

The Jülich Observatory for Cloud Evolution (JOYCE), located at Forschungszentrum Jülich in the most western part of Germany, is a recently established platform for cloud research. The main objective of JOYCE is to provide observations, which improve our understanding of the cloudy boundary layer in a midlatitude environment. Continuous and temporally highly resolved measurements that are specifically suited to characterize the diurnal cycle of water vapor, stability, and turbulence in the lower troposphere are performed with a special focus on atmosphere–surface interaction. In addition, instruments are set up to measure the micro- and macrophysical properties of clouds in detail and how they interact with different boundary layer processes and the large-scale synoptic situation. For this, JOYCE is equipped with an array of state-of-the-art active and passive remote sensing and in situ instruments, which are briefly described in this scientific overview. As an example, a 24-h time s...
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Impact of aerosols and turbulence on cloud droplet growth: an in-cloud seeding case study using a parcel–DNS (direct numerical simulation) approach

by

- Lulin Xue

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Aerosols, their direct and indirect effects

by

- Achuthan Jayaraman

Activation of Rubber-Seed Shell Waste by Malic Acid as Potential CO2 Removal: Isotherm and Kinetics Studies

by

- Azry Borhan

Carbon dioxide (CO2) has been deemed a significant contributor to the climate crisis and has an impact on environmental systems. Adsorption is widely used among other technologies for carbon capture because of its many benefits. As a starting material for the production of activated carbon (AC) by chemical activation using malic acid due to its biodegradable and non-toxic properties, rubber seed shell (RSS) was used as agricultural waste from rubber farming. Sample A6, which was carbonized for 120 min at a temperature of 600 °C and impregnated at a ratio of 1:2, was identified to achieve the highest surface area of 938.61 m2/g with micropore diameter of 1.368 nm, respectively. Using the fixed volumetric approach measured at 25, 50, and 100 °C, the maximum CO2 adsorption capability reported is 59.73 cm3/g of adsorbent. Using the pseudo-first order of Lagergren, the pseudo-second order and the Elovich model, experimental data is modeled. It appears that, based on the correlation coeff...
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Aerosol indirect effects - general circulation model intercomparison and evaluation with satellite data

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by

- boris long

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Diffusional and accretional growth of water drops in a rising adiabatic parcel: effects of the turbulent collision kernel

by

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Paleowind velocity and paleocurrents of pluvial Lake Manly, Death Valley, USA

by

- Summer Keller

...highstand in the Jessup embayment, Nevada. Geological Society of Amer- ica Bulletin 110, 1318-1332. **Berry, E.X**., Hauser, R.K., Lane, W.G., 1981. A wind energy assessment of Southern Cal- ifornia. Project Windes...

Paleowind velocity and paleocurrents of pluvial Lake Manly, Death Valley, USA

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- Summer Keller

Pluvial lake deposits are found throughout western North America and are frequently used to reconstruct regional paleoclimate. In Death Valley, California, USA, we apply the beach particle technique (BPT) of Adams (2003), Sedimentology, 50, 565–577 and Adams (2004), Sedimentology, 51, 671–673 to Lake Manly deposits at the Beatty Junction Bar Complex (BJBC), Desolation Canyon, and Manly Terraces and calculate paleowind velocities of 14–27 m/s. These wind velocities are within the range of present-day wind velocities recorded in the surrounding area. Sedimentary structures and clast provenance at Desolation Canyon and the Manly Terraces indicate sediment transport from north to south. Lake level, based on the elevation of constructional features, indicates that the hill west of the BJBC was an island and that the BJBC spits formed during simple lake regression. The data are consistent with the hypothesis that the present wind regime (velocity and direction) formed the pluvial Lake Man... more ▾

...highstand in the Jessup embayment, Nevada. Geological Society of Amer- ica Bulletin 110, 1318-1332. **Berry, E.X**., Hauser, R.K., Lane, W.G., 1981. A wind energy assessment of Southern Cal- ifornia. Project Windes...

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Modeling springtime shallow frontal clouds with cloud-resolving and single-column models

by

- Marat Khairoutdinov

...I: General de- scription and narrow rainbands, J. Atmos. Sci., 49, 2200 -2217. Berry, E. X. (1968), **Modification of the warm rain process**, in Proceedings of 1st National Conference on Weather Modification, pp. 81 -85, Am. Meteorol. Soc.,...

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Cloud-droplet growth due to supersaturation fluctuations in stratiform clouds

by

- Xiang-Yu Li

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Mesoscale modeling of acidity production in orographic clouds and rain

by

- R. Rosset

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Soot microphysical effects on liquid clouds, a multi-model investigation

by

- govind S MENON

Modeling study of strong acids formation and partitioning in a polluted cloud during wintertime

by

- Leriche, Maud

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...ccretion and self-collection, J. Atmos. Sci., 31, 2118-2126, 1974c. Berry, E.X. and R.L. Reinhardt, **An analysis of cloud drop growth by collection: Part IV. A new parameterization**, J. Atmos. Sci., 31, 2127-2135, 1974d. Bielski B.H.J., D.E. Cabelli, R.L. Arudi, and A.B. Ross, Rea...

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Formation of inhomogeneity in drop concentration induced by the inertia of drops falling in a turbulent flow, and the influence of the inhomogeneity on the drop-spectrum broadening

by

- Mark Pinsky

...aumgardner, D. Batchelor, G. K. Baumgardner, D. and Baker, B. A. Baumgardner, D. C. and Colpitt, A. **Berry, E. X**. and Reinhard, R. L. Hall, W. D. Hobbs, P. V. Hobbs, P. V. and Rangno, A. L. 1967 1992 1992 nature ...

Condensational and collisional growth of cloud droplets in a turbulent environment†

by

- Xiang-Yu Li
- Axel Brandenburg
- Gunilla Svensson
- Nils E. L. Haugen
- Bernhard Mehlig
- Igor Rogachevskii

We investigate the effect of turbulence on the combined condensational and collisional growth of cloud droplets by means of high-resolution direct numerical simulations of turbulence and a superparticle approximation for droplet dynamics and collisions. The droplets are subject to turbulence as well as gravity, and their collision and coalescence efficiencies are taken to be unity. We solve the thermodynamic equations governing temperature, water vapor mixing ratio, and the resulting supersaturation fields together with the Navier–Stokes equation. We find that the droplet size distribution broadens with increasing Reynolds number and/or mean energy dissipation rate. Turbulence affects the condensational growth directly through supersaturation fluctuations, and it influences collisional growth indirectly through condensation. Our simulations show for the first time that, in the absence of the mean updraft cooling, supersaturation-fluctuation-induced broadening of droplet size distributions enhances the collisional growth. This is contrary to classical (nonturbulent) condensational growth, which leads to a growing mean droplet size, but a narrower droplet size distribution. Our findings, instead, show that condensational growth facilitates collisional growth by broadening the size distribution in the tails at an early stage of rain formation. With increasing Reynolds numbers, evaporation becomes stronger. This counteracts the broadening effect due to condensation at late stages of rain formation. Our conclusions are consistent with results of laboratory experiments and field observations, and show that supersaturation fluctuations are important for precipitation.

Collection/aggregation algorithms in Lagrangian cloud microphysical models: rigorous evaluation in box model simulations

by

- Simon Unterstrasser
- Fabian Hoffmann
- Marion Lerch

Recently, several Lagrangian microphysical models have been developed which use a large number of (computational) particles to represent a cloud. In particular, the collision process leading to coalescence of cloud droplets or aggregation of ice crystals is implemented differently in various models. Three existing implementations are reviewed and extended, and their performance is evaluated by a comparison with well-established analytical and bin model solutions. In this first step of rigorous evaluation, box model simulations, with collection/aggregation being the only process considered, have been performed for the three

well-known kernels of Golovin, Long and Hall.

 Besides numerical parameters, like the time step and the number of simulation particles (SIPs) used, the details of how the initial SIP ensemble is created from a prescribed analytically defined size distribution is crucial for the performance of the algorithms. Using a constant weight technique, as done in previous studies, greatly underestimates the quality of the algorithms. Using better initialisation techniques considerably reduces the number of required SIPs to obtain realistic results. From the box model results, recommendations for the collection/aggregation implementation in higher dimensional model setups are derived. Suitable algorithms are equally relevant to treating the warm rain process and aggregation in cirrus.
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...d.minott@erm.com www.erm.com RICHARD L. CARPENTER, JR., Ph.D. J. WILLIAM CONWAY E. DeWAYNE MITCHELL **EDWIN X BERRY**, Ph.D. AECOM Air Dispersion Modeling • Air Toxics • Risk Assessment • Environmental Permitting and ...

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P ARTICLE -T URBULENCE I NTERACTIONS IN A TMOSPHERIC C LOUDS

by

- Shaw, Raymond A.

▪ Turbulence is ubiquitous in atmospheric clouds, which have enormous turbulence Reynolds numbers owing to the large range of spatial scales present. Indeed, the ratio of energy-containing and dissipative length scales is on the order of 105 for a typical convective cloud, with a corresponding large-eddy Reynolds number on the order of 106 to 107. A characteristic trait of high-Reynolds-number turbulence is strong intermittency in energy dissipation, Lagrangian acceleration, and scalar gradients at small scales. Microscale properties of clouds are determined to a great extent by thermodynamic and fluid-mechanical interactions between droplets and the surrounding air, all of which take place at small spatial scales. Furthermore, these microscale properties of clouds affect the efficiency with which clouds produce rain as well as the nature of their interaction with atmospheric radiation and chemical species. It is expected, therefore, that fine-scale turbulence is of direct importance to the evolution of, for example, the droplet size distribution in a cloud. In general, there are two levels of interaction that are considered in this review: (a) the growth of cloud droplets by condensation and (b) the

growth of large drops through the collision and coalescence of cloud droplets. Recent research suggests that the influence of fine-scale turbulence on the condensation process may be limited, although several possible mechanisms have not been studied in detail in the laboratory or the field. There is a growing consensus, however, that the collision rate and collision efficiency of cloud droplets can be increased by turbulence-particle interactions. Adding strength to this notion is the growing experimental evidence for droplet clustering at centimeter scales and below, most likely due to strong fluid accelerations in turbulent clouds. Both types of interaction, condensation and collision-coalescence, remain open areas of research with many possible implications for the physics of atmospheric clouds.
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The 15–25 μm barrier to drop growth in warm rain

by

- R.L. Hawkes

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... de l'Union Géologique et Géophysique Inter- nationale à Lisbonne 1933, 156-173. BERRY, E.X., 1967: **Cloud droplet growth by collection**. J. Atmos. Sci., 24, 688-701. BRAHAM, R.R., 1964: What is the role of ice in summer showers? J. Atm...

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Comparison of Bulk and Bin Warm-Rain Microphysics Models Using a Kinematic Framework

by

- Morrison, Hugh
- Grabowski, Wojciech W.

This paper discusses the development and testing of a bulk warm-rain microphysics model that is capable of addressing the impact of atmospheric aerosols on ice-free clouds. Similarly to previous two-moment bulk schemes, this model predicts the mixing ratios and number concentrations of cloud droplets and drizzle/raindrops. The key elements of the model are the relatively sophisticated cloud droplet activation scheme and a comprehensive treatment of the collision–coalescence mechanism. For the latter, three previously published schemes are selected and tested, with a detailed (bin) microphysics model providing the benchmark. The unique aspect of these tests is that they are performed using a two-dimensional prescribed-flow (kinematic) framework, where both advective transport and gravitational sedimentation are included. Two quasi-idealized test cases are used, the first mimicking a single large eddy in a stratocumulus-topped boundary layer and the second representing a single shallow convective cloud. These types of clouds are thought to be the key in the indirect aerosol effect on climate. Two different aerosol loadings are considered for each case, corresponding to either pristine or polluted environments. In general, all three collision–coalescence schemes seem to capture key features of the bin model simulations (e.g., cloud depth, droplet number concentration, cloud water path, effective radius, precipitation rate, etc.) for the polluted and pristine environments, but there are detailed differences. Two of the collision–coalescence schemes require specification of the width of the cloud droplet spectrum, and model results show significant sensitivity to the specification of the width parameter. Sensitivity tests indicate that a one-moment version of the bulk model for drizzle/rain, which predicts rain/drizzle mixing ratio but not number concentration, produces significant errors relative to the bin model.
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Book 1 Ch 3 Ver 1.0: The Corporate, GOP, and Christian Right's War on Science

by

- James Scaminaci

Consider chapters 1 through 6 to be Version 1.0. Chapters 2 through 6 have Information Cutoff Dates ranging between March 4, 2012 (Ch 2) and November 28, 2014 (Ch 3). I completely stand by the results of these chapters. They are published in current form to get the information out into the public domain. In Version 2.0, each chapter will be reduced in size, like Ch 1a, 1b, 1c, etc., revised and updated with more current information. The theoretical focus, while staying on Fourth Generation Warfare will expand to explain the underlying epistemological warfare of John Boyd,, with its sophisticated and complex Observe-Orient-Decide-Act Loop, Russia's hybrid warfare, and the new Weaponized Narrative Initiative. The inclusion of the latter three ideas are

necessary to explain the very real threat the United States is under—from the Christian Right, the Trumpichy regime, and Russia's hybrid warfare which appeals to the Christian Right (anti-gay, anti-abortion, traditional values), while attempting to exploit and amplify racial, ethnic, gender, and ideological differences in American society. The main focus remains the Christian Right. However, given the close and strong support given by the Christian Right to Trump, additional chapters on Trump and Fourth Generation Warfare will be included in Version 2.0. At this stage, it is more important to put these chapters into the public domain for use by other researchers than to wait for them to be revised and updated.
more ▾

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...ecember 2009 "Freedom Festival" in Post Falls, Washington State, featured an atmospheric physicist, **Edwin X. Berry**, who is linked to Stand Up America (partners with Tea Party Nation and Tea Party Patriots) to oppos...

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...11 E-mail: montever@comcast.net Website: www.mayacamaswx.com CLIMATE PHYSICS, LLC DAVID H. MINOTT **EDWIN X BERRY**, Ph.D. Certified Consulting Meteorologist Air Dispersion Modeling • Air Toxics • Risk Assessment • ...

Incorporation of inline warm rain diagnostics into the COSP2 satellite simulator for process-oriented model evaluation

by

- Takuro Michibata
- Kentaroh Suzuki
- Tomoo Ogura
- Xianwen Jing

. The Cloud Feedback Model Intercomparison Project Observational Simulator Package (COSP) is used to diagnose model performance and physical processes via an apple-to-apple comparison to satellite measurements. Although the COSP provides useful information about clouds and their climatic impact, outputs that have a subcolumn dimension require large amounts of data. This can cause a bottleneck when conducting sets of sensitivity experiments or multiple model intercomparisons. Here, we incorporate two diagnostics for warm rain microphysical processes into the latest version of the simulator (COSP2). The first one is the occurrence frequency of warm rain regimes (i.e., non-precipitating, drizzling, and precipitating) classified according to CloudSat radar reflectivity, putting the warm rain process diagnostics into the context of the geographical distributions of precipitation. The second diagnostic is the probability density function of radar reflectivity profiles normalized by the in-cloud optical depth, the so-called contoured frequency by optical depth diagram (CFODD), which illustrates how the warm rain processes occur in the vertical dimension using statistics constructed from CloudSat and MODIS simulators. The new diagnostics are designed to produce statistics online along with subcolumn information during the COSP execution, eliminating the need to output subcolumn variables. Users can also readily conduct regional analysis tailored to their particular research interest (e.g., land–ocean differences) using an auxiliary post-process package after

the COSP calculation. The inline diagnostics are applied to the MIROC6 general circulation model (GCM) to demonstrate how known biases common among multiple GCMs relative to satellite observations are revealed. The inline multi-sensor diagnostics are intended to serve as a tool that facilitates process-oriented model evaluations in a manner that reduces the burden on modelers for their diagnostics effort.
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...ion of warm cloud microphysical conversion processes, Atmos. Res., 33, 193-206, 1994. Berry, E. X.: **Modification of the Warm Rain Process**, in: Proc. First Conf. on Weather Modification, Albany, NY, Amer. Meteor. Soc, paper presented at 1...

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ＣＩＰ-ＣＳＬＲ法を用いた雲粒の凝縮・蒸発計算法

by

- ONISHI, Ryo
- SUGIMURA, Takeshi
- TAKAHASHI, Keiko

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...ric cloud model. Journal of the Atmospheric Sciences, Vol.31 (1974), pp.1262-1285. (9) Berry, E.X., **Cloud droplet growth by collection**, Journal of the Atmospheric Sciences, Vol.24 (1967), pp.688-701 (10) Kawamura, T. et al., Computati...

Wind Generation in the Future Competitive California Power Market

by

- Sezgen, O.
- Marnay, C.
- Bretz, S.

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...388 0.824 0.523 0.579 0.842 0.523 0.579 6am 0.388 3pm 0.719 6am 0.377 3pm 0.770 6am 0.377 3pm 0.770 **Berry, E.X**, R.K. Hauser, and W.G. Lane 1981. "A Wind Energy Assessment of the Southern California Desert." Atm...

The Route to Raindrop Formation in a Shallow Cumulus Cloud Simulated by a Lagrangian Cloud Model

by

- Yign Noh

.... J. Geophys. Res., 117, D06220, doi:10.1029/2011JD016603. Berry, E. X., and R. L. Reinhardt, 1974: **An analysis of cloud drop growth by collection: Part II. Single initial distributions**. J. Atmos. Sci., 31, 1825-1831, doi:10.1175/1520-0469(1974)031,1825: AAOCDG.2.0.CO;2. Blyth, A. M.,...

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...edford; John S. Kelliher, Boston; Sister Charlene Underhill, Brighton; Ulawo Schaffer, Cambridge; **Edwin X Berry**, DRI, Reno, Nev.; Joseph Daly, Boston; Frank Baumann, Film tech, Inc.; Suellen Mae Mil- leron, Cand...

On the characteristics of aerosol indirect effect based on dynamic regimes in global climate models

by

- Zhang, S.
- Wang, M.
- Ghan, S. J.
- Ding, A.
- Wang, H.
- Zhang, K.
- Neubauer, D.
- Lohmann, U.
- Ferrachat, S.
- Takeamura, T.
- Gettelman, A.
- Morrison, H.
- Lee, Y. H.
- Shindell, D. T.
- Partridge, D. G.
- Stier, P.
- Kipling, Z.
- Fu, C.

Aerosol-cloud interactions continue to constitute a major source of uncertainty for the estimate of climate radiative forcing. The variation of aerosol indirect effects (AIE) in climate models is investigated across different dynamical regimes, determined by monthly mean 500 hPa vertical pressure velocity), lower-tropospheric stability (LTS) and large-scale surface precipitation rate derived from several global climate models (GCMs), with a focus on liquid water path (LWP) response to cloud condensation nuclei (CCN) concentrations. The LWP sensitivity to aerosol perturbation within dynamic regimes is found to exhibit a large spread among these GCMs. It is in regimes of strong large-scale ascend…
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...mental Model, Atmos. Chem. Phys., 13, 3027- 3044, doi:10.5194/acp-13-3027-2013, 2013. Berry, E. X.: **Modification of the warm rain process**, Proc. First Natl. Conf. Weather Modification, American Meteorological Society, State University of...

Modification of Precipitation from Warm Clouds—A Review

by

- Cotton, William R.

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...Modification, 21-25 July 1980, Clermont-Fer- rand, France, Vol. I., pp. 111-118. Berry, E. X, 1967: **Cloud droplet growth by collection**. J. Atmos. Sci., 24, 688-701. Biswas, K. R., and A. S. Dennis, 1971: Formation of a rain shower by ...

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Diffusional and accretional growth of water drops in a rising adiabatic parcel: effects of the turbulent collision kernel

by

- W. W. Grabowski
- L.-P. Wang

. A large set of rising adiabatic parcel simulations is executed to investigate the combined diffusional and accretional growth of cloud droplets in maritime and continental conditions, and to assess the impact of enhanced droplet collisions due to small-scale cloud turbulence. The microphysical model applies the droplet number density function to represent spectral evolution of cloud and rain/drizzle drops, and various numbers of bins in the numerical implementation, ranging from 40 to 320. Simulations are performed applying two traditional gravitational collection kernels and two kernels representing collisions of cloud droplets in the turbulent environment, with turbulent kinetic energy dissipation rates of 100 and 400 cm2 s−3. The overall result is that the rain initiation time significantly depends on the number of bins used, with earlier initiation of rain when the number of bins is low. This is explained as a combination of the increase of the width of activated droplet spectrum and enhanced numerical spreading of the spectrum during diffusional and collisional growth when the number of model bins is low. Simulations applying around 300 bins seem to produce rain at times which no longer depend on

the number of bins, but the activation spectra are unrealistically narrow. These results call for an improved representation of droplet activation in numerical models of the type used in this study. Despite the numerical effects that impact the rain initiation time in different simulations, the turbulent speedup factor, the ratio of the rain initiation time for the turbulent collection kernel and the corresponding time for the gravitational kernel, is approximately independent of aerosol characteristics, parcel vertical velocity, and the number of bins used in the numerical model. The turbulent speedup factor is in the range 0.75–0.85 and 0.60–0.75 for the turbulent kinetic energy dissipation rates of 100 and 400 cm2 s−3, respectively.
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On the Long Term Decay Rate of the Post-Fuego Stratospheric Aerosols Observed by Lidar in Fukuoka

by

- Toshikazu Itabe
- Motowo Fujiwara
- Motokazu Hirono
- Takashi Igarashi

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by

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Aerosol particles in the Mexican East Pacific. Part II: Numerical simulations of the impact of enhanced CCN on precipitation development

by

- Pozo, D.
- Marín, J.C.
- Raga, G.B.
- Baumgardner, D.

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...al Spring Meeting of the American Geophysical Union. Acapulco, Guerrero, Mexico. Berry E. X., 1968. **Modification of the warm rain process**. Preprints of the 1st National Conference of Weather Modification. Albany, N.Y., pp. 81-88. Cifelli...

Use of cloud radar Doppler spectra to evaluate stratocumulus drizzle size distributions in large-eddy simulations with size-resolved microphysics

by

- J. Rémillard
- A. M. Fridlind
- A. S. Ackerman
- G. Tselioudis
- P. Kollias
- D. B. Mechem
- H. E. Chandler
- E. Luke
- R. Wood
- M. K. Witte
- P. Y. Chuang
- J. K. Ayers

A case study of persistent stratocumulus over the Azores is simulated using two independent large-eddy simulation (LES) models with bin microphysics, and forward-simulated cloud radar Doppler moments and spectra are compared with observations. Neither model is able to reproduce the monotonic increase of downward mean Doppler velocity with increasing reflectivity that is observed under a variety of conditions, but for differing reasons. To a varying degree, both models also exhibit a tendency to produce too many of the largest droplets, leading to excessive skewness in Doppler velocity distributions, especially below cloud base. Excessive skewness appears to be associated with an insufficiently sharp reduction in droplet number concentration at diameters larger than ~200 μm, where a pronounced shoulder is found for in situ observations and a sharp reduction in reflectivity size distribution is associated with relatively narrow observed Doppler spectra. Effectively using LES with bin microphysics to study drizzle formation and evolution in cloud Doppler radar data evidently requires reducing numerical diffusivity in the treatment of the stochastic collection equation; if that is accomplished sufficiently to reproduce typical spectra, progress toward understanding drizzle processes is likely.
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..., 13, 108-113, doi:10.1175/1520-0450(1974)013,0108: EFCTTV.2.0.CO;2. --, and R. L. Reinhardt, 1974: **An analysis of cloud drop growth by collection. Part I: Double distributions**. J. Atmos. Sci., 31, 1814-1824, doi:10.1175/1520-0469(1974)031,1814: AAOCDG.2.0.CO;2. Böhm, J. P., ...

An Investigation of Ice Production Mechanisms in Small Cumuliform Clouds Using a 3D Model with Explicit Microphysics. Part I: Model Description

by

- Mikhail Ovchinnikov

ABSTRACT
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...ud development. Quart. J. Roy. Meteor. Soc., 107, 477-502. Berry, E. X., and R. J. Reinhardt, 1974: **An analysis of cloud drop growth by collection: Part I. Double distributions**. J. Atmos. Sci., 31, 1814-1824. Blyth, A. M., and J. Latham, 1990: Airborne studies of the altitudi...

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TRITIUM AND ITS EFFECTS IN THE ENVIRONMENT: A SELECTED LITERATURE SURVEY.

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Assessment of aerosol–cloud–radiation correlations in satellite observations, climate models and reanalysis

by

- F. A.-M. Bender
- L. Frey
- D. T. McCoy
- D. P. Grosvenor
- J. K. Mohrmann

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...over the East China Sea. Res Lett Geophys. https ://doi. org/10.1029/2011G L0472 35 Berry EX (1968) **Modification of the warm rain process**. In: Paper presented at 1st National Conf. on Weather Modification, April 28 May 1. Am. Meteorol. S...

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Early Radar Echoes from Ultragiant Aerosol in a Cumulus Congestus: Modeling and Observations

by

- Charles Knight

...icro- physical mechanisms. J. Appl. Meteor., 32, 608-625. Berry, E. X., and R. L. Reinhardt, 1974a: **An analysis of cloud drop growth by collection. Part I: Double distributions**. J. Atmos. Sci., 31, 1814-1824. –, and –, 1974b: An analysis of cloud drop growth by col- lection...

Model intercomparison of indirect aerosol effects

by

- Penner, J. E.
- Quaas, J.
- Storelvmo, T.
- Takemura, T.
- Boucher, O.
- Guo, H.
- Kirkevåg, A.
- Kristjánsson, J. E.
- Seland, Ø.

. Modeled differences in predicted effects are increasingly used to help quantify the uncertainty of these effects. Here, we examine modeled differences in the aerosol indirect effect in a series

of experiments that help to quantify how and why model-predicted aerosol indirect forcing varies between models. The experiments start with an experiment in which aerosol concentrations, the parameterization of droplet concentrations and the autoconversion scheme are all specified and end with an experiment that examines the predicted aerosol indirect forcing when only aerosol sources are specified. Although there are large differences in the predicted liquid water path among the models, the predicted aerosol first indirect effect for the first experiment is rather similar, about −0.6 Wm−2 to −0.7 Wm−2. Changes to the autoconversion scheme can lead to large changes in the liquid water path of the models and to the response of the liquid water path to changes in aerosols. Adding an autoconversion scheme that depends on the droplet concentration caused a larger (negative) change in net outgoing shortwave radiation compared to the 1st indirect effect, and the increase varied from only 22% to more than a factor of three. The change in net shortwave forcing in the models due to varying the autoconversion scheme depends on the liquid water content of the clouds as well as their predicted droplet concentrations, and both increases and decreases in the net shortwave forcing can occur when autoconversion schemes are changed. The parameterization of cloud fraction within models is not sensitive to the aerosol concentration, and, therefore, the response of the modeled cloud fraction within the present models appears to be smaller than that which would be associated with model "noise". The prediction of aerosol concentrations, given a fixed set of sources, leads to some of the largest differences in the predicted aerosol indirect radiative forcing among the models, with values of cloud forcing ranging from −0.3 Wm−2 to −1.4 Wm−2. Thus, this aspect of modeling requires significant improvement in order to improve the prediction of aerosol indirect effects.
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- Ralf D. Tscheuschner

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Aerosol indirect effects – general circulation model intercomparison and evaluation with satellite data

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- R. Easter

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Precipitation sensitivity to autoconversion rate in a numerical weather-prediction model

by

- John Marsham

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by

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- Priit Tisler

...itation in stratocumulus clouds: observational and modeling results. J. Atmos. Sci. 52, 2329 - 2352. **Berry, E.X**., Reinhard, R.L., 1974. An analysis of cloud drop growth by collection. J. Atmos. Sci. 31, 1814 -18...

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Precipitation Efficiency and its Role in Cloud-Radiative Feedbacks to Climate Variability

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- Yign Noh

...ci. 30 857-78 Takahashi T 1981 J. Atmos. Sci. 38 1991-2013 Soong S T 1974 J. Atmos. Sci. 31 1262-85 **Berry E X** and Reinhardt R L 1974 J. Atmos. Sci. 31 1825-31 Xue Y, Wang L P and Grabowski W W 2008 J. Atmos. S...

Modeling the partitioning of organic chemical species in cloud phases with CLEPS (1.1)

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- Anonymous

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weather-modification progress and the need for interactive research

A review of the status of weather-modification research, with emphasis on progress since 1966. The authors stress that 1) the possibility of inadvertent weather or climate modification is rapidly becoming a probability, as human effects on the atmosphere and the surface of the planet grow at an increasing rate; 2) progress in weather modification research continues to be hampered by the prevalent lack of cohesive effort by both theoreticians and experimenters; 3) computers of advanced design and increased capacity will handle atmospheric models of considerably greater sophistication than in the past; and 4) this is a not-to-be-neglected opportunity for interactive research—constant two-way feedback from theory to experiment to theory, with dynamic atmospheric models facilitating each advance. General and specific recommendations are appended concerning areas most urgently requiring research and instrumentation most drastically needing development.
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Collision Efficiency of Drops in a Wide Range of Reynolds Numbers: Effects of Pressure on Spectrum Evolution

by

- Mark Pinsky

...ation of graupel development. J. Atmos. Sci., 35, 683-689. Berry, E. X., and R. J. Reinhardt, 1974: **An analysis of cloud drop growth by collection: Part I. Double distributions**. J. Atmos. Sci., 31, 1814-1824. Bott, A., 1998: A flux method for the numerical solution of the sto...

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A bulk parameterization of melting snowflakes with explicit liquid water fraction for the COSMO model version 4.14

by

- C. Frick
- A. Seifert
- H. Wernli

. A new snow melting parameterization is presented for the non-hydrostatic limited-area COSMO ("consortium for small-scale modelling") model version 4.14. In contrast to the standard cloud microphysics of the COSMO model, which instantaneously transfers the meltwater from the snow to the rain category, the new scheme explicitly considers the liquid water fraction of the melting snowflakes. These semi-melted hydrometeors have characteristics (e.g., shape and fall speed) that differ from those of dry snow and rain droplets. Where possible, theoretical considerations and results from vertical wind tunnel laboratory experiments of melting snowflakes are used as the basis for characterizing the melting snow as a function of its liquid water fraction. These characteristics include the capacitance, the ventilation coefficient, and the terminal fall speed. For the bulk parameterization, a critical diameter is introduced. It is assumed that particles smaller than this diameter, which increases during the melting process, have completely melted, i.e., they are converted to the rain category. The values of the bulk integrals are calculated with a finite difference method and approximatively represented by polynomial functions, which allows an efficient implementation of the parameterization. Two case studies of (wet) snowfall in Germany are presented to illustrate the potential of the new snow melting parameterization. It is shown that the new scheme (i) produces wet snow instead of rain in some regions with surface temperatures slightly above the freezing point, (ii) simulates realistic atmospheric melting layers with a gradual transition from dry snow to melting snow to rain, and (iii) leads to a slower snow melting process. In the future, it will be important to thoroughly validate the scheme, also with radar data and to further explore its potential for improved surface precipitation forecasts for various meteorological conditions.
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Understanding aerosol-cloud interactions in the development of orographic cumulus congestus during IPHEx

by

- Ana Barros

A new cloud parcel model (CPM) including activation, condensation, collision-coalescence, and lateral entrainment processes is presented here to investigate aerosol-cloud interactions (ACI) in cumulus development prior to rainfall onset. The CPM was employed along with ground based radar and surface aerosol measurements to predict the vertical structure of cloud formation at early stages and evaluated against airborne observations of cloud microphysics and thermodynamic conditions during the Integrated Precipitation and Hydrology Experiment (IPHEx) over the Southern Appalachian Mountains. Further, the CPM was applied to explore the space of ACI physical parameters controlling cumulus congestus growth not available from measurements, and to examine how variations in aerosol properties and microphysical processes influence the evolution and thermodynamic state of clouds over complex terrain via sensitivity analysis. Modelling results indicate that aerosol-cloud droplet number concentr... more ▾

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"Efeito dos núcleos de condensação na formação de nuvens e o desenvolvimento da precipitação na região amazônica durante a estação seca"

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A simulation of the global distribution and radiative forcing of soil dust aerosols at the Last Glacial Maximum

by

- Takemura, T.
- Egashira, M.
- Matsuzawa, K.
- Ichijo, H.
- O'ishi, R.
- Abe-Ouchi, A.

. In this study an integrated simulation of the global distribution and the radiative forcing of soil dust aerosols at the Last Glacial Maximum (LGM) is performed with an aerosol climate model, SPRINTARS. It is compared with another simulation for the present climate condition. The global total emission flux of soil dust aerosols at the LGM is simulated to be about 2.4 times as large as that in the present climate, and the simulated deposition flux is in general agreement with estimations from ice core and marine sediment samplings though it appears to be underestimated over the Antarctic. The calculated direct radiative forcings of soil dust aerosols at the LGM is close to zero at the tropopause and −0.4 W m−2 at the surface. These radiative forcings are about twice as large as those in the present climate. SPRINTARS also includes the microphysical parameterizations of the cloud-aerosol interaction both for liquid water and ice crystals, which affect the radiation budget. The positive radiative forcing from the indirect effect of soil dust aerosols is mainly caused by their properties to act as ice nuclei. This effect is simulated to be smaller (−0.9 W m−2) at the LGM than in the present. It is suggested that atmospheric dust might contribute to the cold climate during the glacial periods both through the direct and indirect effects, relative to the interglacial periods.
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Dynamics of Convective Clouds and 'CISK' in Vertical Shear Flow-with its Application to Easterly Waves and Squall-Line Systems

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- Masanori Yamasaki

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...of hurricane-type vortices in a general circulation model. Tellus, 34, 440-457. Berry, E. X., 1968: **Modification of the warm rain process**. Proc. First National Conf. Weather Modification, Amer, Meteor. Soc., Boston, Mass., 81-85. Betts, ...

Aerosol indirect effects – general circulation model intercomparison and evaluation with satellite data

by

- Graham Feingold
- Yves Balkanski
- Alf Kirkevåg
- L. Donner

...direct radiative forcing from satellite mea- surements, Nature, 438, 1138-1141, 2005. Berry, E. X.: **Cloud droplet growth by collection**, J. Atmos. Sci., 24, 688-701, 1967. Bony, S. and Emanuel, K. E.: A parameterization of the cloudi- ...

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Explicit Forecasts of Winter Precipitation Using an Improved Bulk Microphysics Scheme. Part II: Implementation of a New Snow Parameterization

by

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- Field, Paul R.
- Rasmussen, Roy M.
- Hall, William D.

A new bulk microphysical parameterization (BMP) has been developed for use with the Weather Research and Forecasting (WRF) Model or other mesoscale models. As compared with earlier single-moment BMPs, the new scheme incorporates a large number of improvements to both physical processes and computer coding, and it employs many techniques found in far more sophisticated spectral/bin schemes using lookup tables. Unlike any other BMP, the assumed snow size distribution depends on both ice water content and temperature and is represented

as a sum of exponential and gamma distributions. Furthermore, snow assumes a nonspherical shape with a bulk density that varies inversely with diameter as found in observations and in contrast to nearly all other BMPs that assume spherical snow with constant density. The new scheme's snow category was readily modified to match previous research in sensitivity experiments designed to test the sphericity and distribution shape characteristics. From analysis of four idealized sensitivity experiments, it was determined that the sphericity and constant density assumptions play a major role in producing supercooled liquid water whereas the assumed distribution shape plays a lesser, but nonnegligible, role. Further testing using numerous case studies and comparing model results with in situ and other observations confirmed the results of the idealized experiments and are briefly mentioned herein, but more detailed, microphysical comparisons with observations are found in a companion paper in this series (Part III, forthcoming).
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Eulerian modeling of aerosol dynamics

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Global distribution and radiative forcing of soil dust aerosols in the Last Glacial Maximum simulated by the aerosol climate model

by

- Takemura, T.
- Egashira, M.
- Matsuzawa, K.
- Ichijo, H.
- O'ishi, R.
- Abe-Ouchi, A.

. The integrated simulation for the global distribution and radiative forcing of soil dust aerosols in the Last Glacial Maximum (LGM) is done by an aerosol climate model, SPRINTARS, in this study. It is compared with another simulation in the present climate condition. The global total emission flux of soil dust aerosols in the LGM is simulated to be about 2.4 times as large as that in the present climate, and the simulated deposition flux is in general agreement with estimations from ice core and marine sediment samplings though it might be underestimated over the Antarctic. The calculated direct radiative forcing of soil dust aerosols in the LGM is close to zero at the tropopause and −0.4 W m−2 at the surface, which are about twice as large as those in the present climate. SPRINTARS also includes the microphysical parameterizations of the cloud-aerosol interaction both for liquid water and ice crystals, which affect the radiation budget. The positive radiative forcing of the indirect effect due to soil dust aerosols, that is mainly caused by a role of ice nuclei, is simulated to be smaller in the LGM than in the present. It is suggested that atmospheric dust might contribute to the cold climate during the glacial periods both through the direct and indirect effects, relative to the interglacial periods.
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On the application of the classic Kessler and Berry schemes in Large Eddy Simulation models with a particular emphasis on cloud autoconversion, the onset time of precipitation and droplet evaporation

by

- Ghosh, S.
- Jonas, P. R.

. Many Large Eddy Simulation (LES) models use the classic Kessler parameterisation either as it is or in a modified form to model the process of cloud water autoconversion into precipitation. The Kessler scheme, being linear, is particularly useful and is computationally straightforward to implement. However, a major limitation with this scheme lies in its inability to predict different autoconversion rates for maritime and continental clouds. In contrast, the Berry formulation

overcomes this difficulty, although it is cubic. Due to their different forms, it is difficult to match the two solutions to each other. In this paper we single out the processes of cloud conversion and accretion operating in a deep model cloud and neglect the advection terms for simplicity. This facilitates exact analytical integration and we are able to derive new expressions for the time of onset of precipitation using both the Kessler and Berry formulations. We then discuss the conditions when the two schemes are equivalent. Finally, we also critically examine the process of droplet evaporation within the framework of the classic Kessler scheme. We improve the existing parameterisation with an accurate estimation of the diffusional mass transport of water vapour. We then demonstrate the overall robustness of our calculations by comparing our results with the experimental observations of Beard and Pruppacher, and find excellent agreement.Key words. Atmospheric composition and structure · Cloud physics and chemistry · Pollution · Meteorology and atmospheric dynamics · Precipitation
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...tion of small water drops falling at terminal velocity in air, J. Atmos. Sci., 28, 1455±1464, 1971. **Berry, E. X**., Modi®cation of the warm rain process, Proc. First Natl. Conf. Weather modi®cation, Ed. American M...

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A Bulk Microphysics Parameterization with Multiple Ice Precipitation Categories

by

- Straka, Jerry M.
- Mansell, Edward R.

A single-moment bulk microphysics scheme with multiple ice precipitation categories is described. It has 2 liquid hydrometeor categories (cloud droplets and rain) and 10 ice categories that are characterized by habit, size, and density—two ice crystal habits (column and plate),

rimed cloud ice, snow (ice crystal aggregates), three categories of graupel with different densities and intercepts, frozen drops, small hail, and large hail. The concept of riming history is implemented for conversions among the graupel and frozen drops categories. The multiple precipitation ice categories allow a range of particle densities and fall velocities for simulating a variety of convective storms with minimal parameter tuning. The scheme is applied to two cases—an idealized continental multicell storm that demonstrates the ice precipitation process, and a small Florida maritime storm in which the warm rain process is important.
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Aerosol effects on clouds and precipitation during the 1997 smoke episode in Indonesia

by

- H.-F. Graf
- J. Yang
- T. M. Wagner

. In 1997/98 a severe smoke episode due to extensive biomass burning, especially of peat, was observed over Indonesia. September 1997 was the month with the highest aerosol burden. This month was simulated using the limited area model REMOTE driven at its lateral boundaries by ERA40 reanalysis data. REMOTE was extended by a new convective cloud parameterization mimicking individual clouds competing for instability energy. This allows for the interaction of aerosols and convective clouds and precipitation. Results show that convective precipitation is diminished at all places with high aerosol loading, but at some areas with high background humidity precipitation from large-scale clouds may over-compensate the loss in convective rainfall. At individual time steps, very few cases were found when polluted convective clouds produced intensified rainfall via mixed phase microphysics. However, these cases are not unequivocal and opposite results were also simulated, indicating that other than aerosol-microphysics effects have important impact on the results. Overall, the introduction of the new cumulus parameterization and of aerosol-cloud interaction improved the simulation of precipitation patterns and total amount.
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Physically based two-moment bulkwater parametrization for warm-cloud microphysics

by

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- Liu, Sen-Tsong

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The potential for elucidating sulfate and acidity production in clouds using a mesoscale model with quasi-spectral microphysics

by

- R. Rosset

...eading, England and also Metkorologie Nationale, Paris. zyxwvut zyxwvuts zyxwv zyxwvutsr REFERENCES **Berry, E. X**. and Reinhardt, R. L. 1973. Modeling of condensation and collection within clouds. D.R.I. Phys. Sci...

New RAMS cloud microphysics parameterization part I: the single-moment scheme

by

- Jerry Harrington

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Multiscale cloud system modeling

by

- Tao, Wei-Kuo
- Moncrieff, Mitchell W.

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Potential of Convective Cloud Seeding in the Southwest

by

- Herbert B. Osborn
- Osborn, Herbert B.
- Lane, Leonard J.

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Coastal effects in the Eastern Mediterranean as seen from experiments using a cloud ensemble model with detailed description of warm and ice microphysical processes

by

- Igor Sednev

... frontogenesis. Fifth Conf. Meteorol. Ocean- ogr. Coastal Zone, May 6-9, Miami, Florida, pp. 26-29. **Berry, E.X**. and Reinhard, R.L., 1974. An analyses of cloud drop grows by collection: part 1. Double distributi...

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Impact of aerosols on precipitation over the Maritime Continent simulated by a convection-permitting model

by

- Muhammad E. E. Hassim
- W. W. Grabowski
- T. P. Lane

We examine the impact of assumed cloud droplet concentration on the simulated diurnal cycle of rainfall over New Guinea and surrounding seas using convection-permitting numerical simulations with the Weather Research and Forecasting (WRF) model. The simulations mimic effects of cloud condensation nuclei on cloud and precipitation processes. They follow

simulations reported in Hassim et al (ACP 2016) that focused on dynamical aspects, namely the topographic forcing and the off-shore propagation of convective systems that contribute to the observed early-morning rainfall maximum north-east of New Guinea. Simulations reported in this current study apply the bulk cloud microphysics of Thompson et al. with contrasting cloud droplet concentrations of 100 and 1,000 per cc, referred to as pristine and polluted conditions, respectively. Overall, the assumed cloud droplet concentration has a small impact on the simulated convection. This emphasizes the predominant control from the diurnal cycle and the large-scale conditions. Pristine convection results in a 15-20 % larger surface accumulated rainfall over both land and ocean, and a noticeable shift of the cloud top height distribution, a reduction of the contribution of shallow cloudiness (cloud tops below 3 km) and an increase of the population of deep clouds (cloud tops above 9 km). The simulated impact on precipitation and cloud fields is in stark contrast to previous modelling studies that document small enhancement of surface precipitation and significant increase of the cloud top height in polluted conditions. Analysis of microphysical fields suggests that the simulated small enhancement of precipitation in pristine conditions comes from more efficient rain processes below the freezing level and enhanced graupel initiation and growth aloft. The increase of the cloud top height is arguably due to precipitation off-loading increasing cloud buoyancy aloft that has been shown to operate in shallow warm convection. However, the relatively low horizontal resolution and application of the bulk cloud microphysics warrants follow-up studies to assess validity of the impacts documented in the current study.
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An evaluation of the effect of reductions in ambient levels of primary pollutants on sulfate and nitrate wet deposition

by

- Youngsoo Chang

... suitable for inclusion in atmosphetic sitnu- lation models. Atmospheric Envfronment 16, 1341-1355. **Berry E. X**. and R~nhardt R. L. (1974) An analysis of cloud drop growth by collection. J. ~tmos. Sci. 31,2118-2...

Impacts of Aerosol Particle Size Distribution and Land Cover Land Use on Precipitation in a Coastal Urban Environment Using a Cloud-Resolving Mesoscale Model

by

- Nathan Hosannah
- Jorge E. Gonzalez

Urban environments influence precipitation formation via response to dynamic effects, while aerosols are intrinsically necessary for rainfall formation; however, the partial contributions of each on urban coastal precipitation are not yet known. Here, the authors use aerosol particle size distributions derived from the NASA aerosol robotic network (AERONET) to estimate submicron cloud condensation nuclei (CCN) and supermicron CCN (GCCN) for ingestion in the regional atmospheric modeling system (RAMS). High resolution land data from the National Land Cover Database (NLCD) were assimilated into RAMS to provide modern land cover and land use (LCLU). The first two of eight total simulations were month long runs for July 2007, one with constant PSD values and the second with AERONET PSDs updated at times consistent with observations. The third and fourth runs mirrored the first two simulations for “No City” LCLU. Four more runs addressed a one-day precipitation event under City and No City LCLU, and two different PSD conditions. Results suggest that LCLU provides the dominant forcing for urban precipitation, affecting precipitation rates, rainfall amounts, and spatial precipitation patterns. PSD then acts to modify cloud physics. Also, precipitation forecasting was significantly improved under observed PSD and current LCLU conditions.
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A Numerical Solution of the Kinetic Collection Equation Using High Spectral Grid Resolution: A Proposed Reference

by

- Zev Levin

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Early Radar Echoes from Ultragiant Aerosol in a Cumulus Congestus: Modeling and Observations

by

- Sonia Lasher-trapp

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Characteristics of Droplet Size Distributions in Low-Level Stratiform Clouds Observed from Tokyo Skytree

by

- Ryohei MISUMI
- Yasushi UJI
- Yutaka TOBO
- Kazuhiko MIURA
- Jun UETAKE
- Yoko IWAMOTO
- Takeshi MAESAKA
- Koyuru IWANAMI

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Population balance modelling of drum granulation of materials with wide size distribution

by

- Sotiris e. Pratsinis

...loud Physics, Toronto, Canada, 1968, pp. 115-125. M.V. Smoluchowski, Z. Phys. Chem., 92 (1917) 129. **E.X. Berry**, J. Atmos. Sci., 24 (1967) 688. R.L. Drake, A general mathematical survey of coagulation equation, ...

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Numerical Experiment of Orographic Heavy Rainfall due to a Stratif orm Cloud

by

- Yukio Gocho

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..., 1977: Orographic rainfall in warm sectors of depressions. Quart. J. Roy. Met. Soc., 103, 269-280. **Berry, E. X**, 1967: Cloud droplet growth by collec- tion. J. Atmos. Sci., 24, 688-701. Best, A. C., 1950: The si...

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Growth of Cloud Droplets in a Turbulent Environment

by

- Lian-Ping Wang

...6. 22 views of the global albedo: comparison between 20 GCMs and two satellites. Tellus A 58:320-30 **Berry EX**, Reinhardt RL. 1974. An analysis of cloud drop growth by collection: Part 1. Double distribution. J...

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Population balance modelling of drum granulation of materials with wide size distribution

by

- Bryan Ennis

A population balance model is developed to describe the drum granulation of feeds with a broad size distribution (e.g. recycled fertiliser granules). Granule growth by coalescence is

modelled with a sequential two-stage kernel. The first stage of granulation falls within a non-inertial regime as defined by Ennis et al. (Powder Technol., 65 (1991) 257–272), with growth occurring by random coalescence.
more ▾

...loud Physics, Toronto, Canada, 1968, pp. 115-125. M.V. Smoluchowski, Z. Phys. Chem., 92 (1917) 129. **E.X. Berry**, J. Atmos. Sci., 24 (1967) 688. R.L. Drake, A general mathematical survey of coagulation equation, ...

High Ice Water Concentrations in the 19 August 2015 Coastal Mesoconvective System

by

- Fred Proctor
- Steven Harrah
- George F. Switzer
- Justin K. Strickland
- Patricia J. Hunt

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... 1185-1206, doi:10.1175/1520-0469(1983)040<1185:tmamsa>2.0.co;2. Berry, E.X., and Reinhardt, R.E., "**An Analysis of Cloud Drop Growth by Collection. Part I: Double Distributions**," Journal of the. Atmospheric Sciences, Vol. 31, October 1974, pp. 1814-1824, doi:10.1175/1520-0469...

Toward a Better Understanding of the Moist Atmosphere: Cooperative Interaction between Moist Convection and the Larger-Scale

by

- Masanori Yamasaki

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... convective structure of a hurricane rainband, J. Atmos. Sci., 40, 2125- 2137. Berry, E. X. (1968), **Modification of the warm rain process**, Pro. First Na- tional Conf. Weather Modification, Amer. Meteor. Soc., Boston, Mass., 81-85. Bister...

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On the characteristics of aerosol indirect effect based on dynamic regimes in global climate models

by

- Zhang, S.
- Wang, M.
- Ghan, S. J.
- Ding, A.
- Wang, H.
- Zhang, K.

- Neubauer, D.
- Lohmann, U.
- Ferrachat, S.
- Takeamura, T.
- Gettelman, A.
- Morrison, H.
- Lee, Y. H.
- Shindell, D. T.
- Partridge, D. G.
- Stier, P.
- Kipling, Z.
- Fu, C.

Aerosol-cloud interactions continue to constitute a major source of uncertainty for the estimate of climate radiative forcing. The variation of aerosol indirect effects (AIE) in climate models is investigated across different dynamical regimes, determined by monthly mean 500 hPa vertical pressure velocity), lower-tropospheric stability (LTS) and large-scale surface precipitation rate derived from several global climate models (GCMs), with a focus on liquid water path (LWP) response to cloud condensation nuclei (CCN) concentrations. The LWP sensitivity to aerosol perturbation within dynamic regimes is found to exhibit a large spread among these GCMs. It is in regimes of strong large-scale ascend…
more ▾

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...mental Model, Atmos. Chem. Phys., 13, 3027- 3044, doi:10.5194/acp-13-3027-2013, 2013. Berry, E. X.: **Modification of the warm rain process**, Proc. First Natl. Conf. Weather Modification, American Meteorological Society, State University of...

An evaluation of simulated particulate sulfate over East Asia through global model intercomparison

by

- Goto, Daisuke
- Nakajima, Teruyuki
- Dai, Tie
- Takemura, Toshihiko
- Kajino, Mizuo
- Matsui, Hitoshi
- Takami, Akinori
- Hatakeyama, Shiro
- Sugimoto, Nobuo
- Shimizu, Atsushi
- Ohara, Toshimasa

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Collection/Aggregation in a Lagrangian cloud microphysical model: Insights from column model applications using LCM1D (v0.9)

by

- Simon Unterstrasser
- Fabian Hoffmann
- Marion Lerch

Lagrangian cloud models (LCMs) are considered the future of cloud microphysical modeling. However, LCMs are computationally expensive due to the typically high number of simulation particles (SIPs) necessary to represent microphysical processes such as collection/aggregation successfully. In this study, the representation of collection/aggregation is explored in one-dimensional column simulations, allowing for the explicit consideration of sedimentation, complementing the authors previous study on zero-dimensional collection in a single grid box. Two variants of the Lagrangian probabilistic all-or-nothing (AON) collection algorithm are tested that mainly differ in the assumed spaatial distribution of the droplet ensemble: The first variant assumes the droplet ensemble to be well-mixed in a predefined three-dimensional grid box (WM3D), while the second variant considers explicitly the vertical coordinate of the SIPs, reducing the well-mixed assumption to a two-dimensional, horizontal plane (WM2D). Since the number of calculations in AON depends quadratically on the number of SIPs, an approach is tested that reduces the number of calculations to a linear dependence (so-called linear sampling). All variants are compared to established Eulerian bin model solutions. Generally, all methods approach the same solutions, and agree well if the methods are applied with sufficiently high accuracy (foremost the number of SIPs, timestep, vertical grid spacing). However, it is found that the rate of convergence depends on the applied model variant. The dependence on the vertical grid spacing can be reduced if AON WM2D is applied. The study also shows that the AON simulations with linear sampling, a common speed-up measure, converges slower, as smaller timesteps are required to reach convergence compared to simulations with a quadratic dependence on the number of SIPs. Most importantly, the study highlights that results generally require a smaller number of SIPs per grid box for convergence than previous box simulations indicated. The reason is the ability of sedimenting SIPs to interact with an effectively larger ensemble of particles when they are not restricted to a single grid box. Since sedimentation is considered in most commonly applied three-dimensional models, the results indicate smaller computational requirements for successful simulations than previously assumed, encouraging a wider use of LCMs in the future;

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Eulerian and Lagrangian approaches to multidimensional condensation and collection

by

- Xiang-Yu Li
- A. Brandenburg
- N. E. L. Haugen
- G. Svensson

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...ys. Rev. E, 93, 031,102, doi:10.1103/ PhysRevE.93.031102. Berry, E. X., and R. L. Reinhardt (1974), **An analysis of cloud drop growth by collection: Part i. double distributions**, Journal of the Atmospheric Sciences, 31(7), 1814-1824, doi: 10.1175/1520-0469(1974)031 1814:AAOCDG...

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A Numerical Simulation of Wintertime, Orographic Precipitation: Part I. Description of Model Microphysics and Numerical Techniques

by

- Young, Kenneth C.

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...0.1175/1520-0469(1974)031<1735:ANSOWO>2.0.CO;2 by guest on 29 June 2020 SCIENCES Berry, E. X, 1966: **Cloud droplet growth by collection**. /. Atmos. Set., 24, 688-701. Bryant, G. W., J. Hallett and B. J. Mason, 1959: The epitaxial growth...

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Simulated Electrification of a Small Thunderstorm with Two-Moment Bulk Microphysics

by

- Mansell, Edward R.
- Ziegler, Conrad L.
- Bruning, Eric C.

Electrification and lightning are simulated for a small continental multicell storm. The results are consistent with observations and thus provide additional understanding of the charging processes and evolution of this storm. The first six observed lightning flashes were all negative cloud-to-ground (CG) flashes, after which intracloud (IC) flashes also occurred between middle and upper levels of the storm. The model simulation reproduces the basic evolution of lightning from low and middle levels to upper levels. The observed lightning indicated an initial charge structure of at least an inverted dipole (negative charge above positive). The simulations show that noninductive charge separation higher in the storm can enhance the main negative charge sufficiently to produce negative CG flashes before upper-level IC flashes commence. The result is a “bottom-heavy” tripole charge structure with midlevel negative charge and a lower positive charge region that is more significant than the upper positive region, in contrast to the traditional tripole structure that has a less significant lower positive charge region. Additionally, the occurrence of cloud-to-ground lightning is not necessarily a result of excess net charge carried by the storm, but it is primarily caused by the local potential imbalance between the lowest charge regions. The two-moment microphysics scheme used for this study predicted mass mixing ratio and number concentration of cloud droplets, rain, ice crystals, snow, and graupel. Bulk particle density of graupel was also predicted, which allows a single category to represent a greater range of particle characteristics. (An additional hail category is available but was not needed for the present study.) The prediction of hydrometeor number concentration is particularly critical for charge separation at higher temperatures (−5° amp;lt; −20°C) in the mixed phase region, where ice crystals are produced by rime fracturing (Hallett–Mossop process) and by splintering of freezing drops. Cloud droplet concentration prediction also affected the rates of inductive charge separation between graupel and droplets.
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Does the threshold representation associated with the autoconversion process matter?

by

- Guo, H.
- Liu, Y.
- Penner, J. E.

. Different ad hoc threshold functions associated with the autoconversion process have been arbitrarily used in atmospheric models. However, it is unclear how these ad hoc functions

impact model results. Here systematic investigations of the sensitivities of climatically-important properties: CF (cloud fraction), LWP (liquid water path), and AIE (aerosol indirect effect) to threshold functions have been performed using a 3-D cloud-resolving model. It is found that the effect of threshold representations is larger on instantaneous values than on daily averages; and the effect depends on the percentage of clouds in their transitional stages of converting cloud water to rain water. For both the instantaneous values and daily averages, the sensitivity to the specification of critical radius is more significant than the sensitivity to the of the threshold representation (as embodied in the relative dispersion of droplet size distribution) for drizzling clouds. Moreover, the impact of threshold representations on the AIE is stronger than that on CF and LWP.
more ▾

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Impact of including the plume rise of vegetation fires in numerical simulations of associated atmospheric pollutants

by

- Freitas, S. R.
- Longo, K. M.
- Andreae, M. O.

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Estimation of Liquid Water Amount in an Extended Cloud by Nimbus-5 Microwave Data

by

- Takao Takeda
- Shohei Natsuki

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CIP-CSLR Scheme for Condensation and Evaporation Calculations of Water Droplets

by

- ONISHI, Ryo
- SUGIMURA, Takeshi
- TAKAHASHI, Keiko

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The super-droplet method for the numerical simulation of clouds and precipitation: a particle-based and probabilistic microphysics model coupled with a non-hydrostatic model

by

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- Kusano, K.
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Turbulence effects on the collision kernel. I: Formation of velocity deviations of drops falling within a turbulent three-dimensional flow

by

- Mark Pinsky

...1969 1991 1975 I972 1976 1996 1993 1977 1989 1987 1996 Sedunov. Y. S. Ackerman, B. Batchelor, G. K. **Berry, E. X**. and Reinhard, R. L. Elghobashi, zyxwvutsrqp S. and Truesdell, G. C. Fung, J. C. H. Gradsteyn, I. S...

Takahashi 구름모형에서의 얼음입자 충돌효율 개선

by

- Lee, Hannah
- Yum, Seong Soo

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program of the Eighth Technical Conference on Hurricanes and Tropical Meteorology of the American Meteorological Society, May 14–17, 1973, Key Biscayne, Miami, Fla.

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A Multimodel Study on Warm Precipitation Biases in Global Models Compared to Satellite Observations

by

- Xianwen Jing
- Kentaroh Suzuki
- Huan Guo
- Daisuke Goto
- Tomoo Ogura
- Tsuyoshi Koshiro
- Johannes Mülmenstädt

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How Mountain Geometry Affects Aerosol-Cloud-Precipitation Interactions: Part I. Shallow Convective Clouds

by

- Jaemyeong Mango SEO
- Hyunho LEE
- Sungju MOON
- Jong-Jin BAIK

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Numerical Study of the Effect of CCN on the Size Distribution of Cloud Droplets

by

- Naomi Kuba
- Takao Takeda

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...は,大雲粒は主に巨大粒子雲核上にできた雲粒をもとに作られ,それらの雲粒どうしの併合が大雲粒の生成に大きく寄与している。 **Berry, E. X**., 1967: Cloud droplet growth by col- lection. J. Atmos. Sci., 24, 688-701. Clark, T. L., 1973: Nume...

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Evaluation of Rain Microphysics Using a Radar Simulator and Numerical Models: Comparison of Two-Moment Bulk and Spectral Bin Cloud Microphysics Schemes

by

- Naomi Kuba
- Tatsuya Seiki
- Kentaroh Suzuki
- Woosub Roh
- Masaki Satoh

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...f Advances in Modeling Earth Systems KUBA ET AL. 18 of 18 Berry, E. X., & Reinhardt, R. L. (1974a). **An analysis of cloud drop growth by collection: Part I. Double distributions**. Journal of the Atmospheric Sciences, 31(7), 1814-1824. https://doi.org/10.1175/1520-0469(1974)031<...

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Notes on the state-of-the-art numerical modeling of cloud microphysics

by

- H. Krugliak

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Density separation of small particles by magnetic fluid sink-float methods :

by

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- Sengers, J V

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Simulation of precipitation formation in the Eastern Mediterranean coastal zone using a spectral microphysics cloud ensemble model

by

- Igor Sednev

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Some effects of cloud–aerosol interaction on cloud microphysics structure and precipitation formation: numerical experiments with a spectral microphysics cloud ensemble model

by

- Igor Sednev

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Radar Analysis of Precipitation Initiation in Maritime versus Continental Clouds near the Florida Coast: Inferences Concerning the Role of CCN and Giant Nuclei

by

- Göke, Sabine
- Ochs, Harry T.
- Rauber, Robert M.

A method of analyzing radar data is developed and applied to determine whether the X-band radar reflectivity evolution of clouds observed during summertime on the northeast Florida coast during the Small Cumulus Microphysics Study (SCMS) shows distinct differences in precipitation development that can be associated with the clouds' maritime or continental characteristics. For this study, the entire National Center for Atmospheric Research CP2 radar dataset from SCMS was examined, and 38 clouds were used. For these clouds the evolution in X-band radar reflectivity, from the clouds' earliest detection through precipitation, was clearly documented and met specific requirements concerning the clouds' location relative to the coastline and direction of movement. Since cloud condensation nuclei (CCN) and giant and ultragiant nuclei (GN) measurements were not available for the specific clouds used in this study, proxies were used to partition the clouds into four groups based on the cloud location and direction of movement. Specifically, it was assumed that clouds forming over the ocean during onshore flow had maritime characteristics (group 1: low CCN, high GN), clouds forming over land during onshore flow would have modified maritime characteristics (group 2: high CCN, high GN), clouds forming over land during offshore flow would have continental characteristics (group 3: high CCN, low GN), and clouds forming over the ocean during offshore flow would have modified continental characteristics (group 4: high CCN, high GN). These assumptions are based on past measurements presented by Sax and Hudson. Then, these populations were statistically compared using the nonparametric multiresponse permutation procedure developed by Mielke et al. A comparison of groups 1 and 2 provided a test of the role of CCN concentrations in precipitation development in these cloud populations. A comparison of groups 3 and 4 provided a test of the role of GN concentrations in precipitation development in these cloud populations. The two cloud populations that were disjoint at a statistically significant level were groups 1 and 2. For these groups, the analysis showed that the median characteristic total water content of the truly maritime clouds (group 1) was about half that of the modified maritime clouds (group 2) at the time of precipitation formation. The characteristic time to precipitation formation was about 60% smaller for the truly maritime clouds. Thus, the characteristic reflectivity threshold for precipitation development was reached at a much lower altitude above cloud base in a much faster time in the truly maritime clouds. This result supports the conclusions of Hudson and Yum that precipitation development in the SCMS clouds was primarily controlled by CCN concentrations rather than GN concentrations.

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A Numerical Solution of the Kinetic Collection Equation Using High Spectral Grid Resolution: A Proposed Reference

by

- Zev Levin

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A further study of the tropical cyclone without parameterizing the effects of cumulus convection.

by

- Yamasaki, Masanori

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Challenges in constraining anthropogenic aerosol effects on cloud radiative forcing using present-day spatiotemporal variability

by

- Ghan, Steven
- Wang, Minghuai
- Zhang, Shipeng

- Ferrachat, Sylvaine
- Gettelman, Andrew
- Griesfeller, Jan
- Kipling, Zak
- Lohmann, Ulrike
- Morrison, Hugh
- Neubauer, David
- Partridge, Daniel G.
- Stier, Philip
- Takemura, Toshihiko
- Wang, Hailong
- Zhang, Kai

A large number of processes are involved in the chain from emissions of aerosol precursor gases and primary particles to impacts on cloud radiative forcing. Those processes are manifest in a number of relationships that can be expressed as factors dlnX/dlnY driving aerosol effects on cloud radiative forcing. These factors include the relationships between cloud condensation nuclei (CCN) concentration and emissions, droplet number and CCN concentration, cloud fraction and droplet number, cloud optical depth and droplet number, and cloud radiative forcing and cloud optical depth. The relationship between cloud optical depth and droplet number can be further decomposed into the sum of two terms involving the relationship of droplet effective radius and cloud liquid water path with droplet number. These relationships can be constrained using observations of recent spatial and temporal variability of these quantities. However, we are most interested in the radiative forcing since the preindustrial era. Because few relevant measurements are available from that era, relationships from recent variability have been assumed to be applicable to the preindustrial to present-day change. Our analysis of Aerosol Comparisons between Observations and Models (AeroCom) model simulations suggests that estimates of relationships from recent variability are poor constraints on relationships from anthropogenic change for some terms, with even the sign of some relationships differing in many regions. Proxies connecting recent spatial/temporal variability to anthropogenic change, or sustained measurements in regions where emissions have changed, are needed to constrain estimates of anthropogenic aerosol impacts on cloud radiative forcing. more ▾

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Experimentation Involving Controversial Scientific and Technological Issues: Weather Modification as a Case Illustration

by

- Henry Lambright

...sons provided valuable information for this assessment. They included B. Ackerman, W. C. Ackermann, **E. X. Berry**, R. R. Braham, Jr., K. Brown, C. Downie, A. Dennis, R. Dirks, J. Firor, K. R. Gabriel, G. Goyer, B....

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Modeling springtime shallow frontal clouds with cloud-resolving and single-column models

by

- Richard Somerville

...I: General de- scription and narrow rainbands, J. Atmos. Sci., 49, 2200 -2217. Berry, E. X. (1968), **Modification of the warm rain process**, in Proceedings of 1st National Conference on Weather Modification, pp. 81 -85, Am. Meteorol. Soc.,...

Numerical Error Analysis of Solvers Using Cumulative Number Distribution with Volume-Ratio Grid Spacing in Initially Particle-Free Nucleation-Condensation Systems

by

- Yamamoto, Masaru

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Improving the representation of supercooled liquid water in the HARMONIE-AROME weather forecast model

by

- Bjørg Jenny Kokkvoll Engdahl
- Gregory Thompson
- Lisa Bengtsson

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...n. Weather Rev. 145, 1919-1935. doi:10.1175/MWR-D-16-0417.1 Berry, E. X. and Reinhardt, R. L. 1974. **An analysis of cloud drop growth by collection part II. Single initial distributions**. J. Atmos. Sci. 31, 1825-1831. doi:10.1175/ 1520-0469(1974)031<1825:AAOCDG>2.0.CO;2 Bigg, E. K. 195...

Numerical investigations for the impacts of triple-moment and double-moment condensation schemes on the warm rain formation

by

- Wei DENG
- Ji-Ming SUN
- Heng-Chi LEI

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Growth of Cloud Droplets by Turbulent Collision–Coalescence

by

- Lian-Ping Wang

...f microphysical mechanisms. J. Appl. Meteor., 32, 608-625. Berry, E. X., and R. I. Reinhardt, 1974: **An analysis of cloud drop growth by collection: Part I. Double distributions**. J. Atmos. Sci., 31, 1814-1824. Blyth, A. M., S. G. Lasher-Trapp, W. A. Cooper, C. A. Knight, and J...

A Possible Use of Multi-Sensor Satellite Observations for Inferring the Drop Collection Efficiency of Warm Clouds

by

- Suzuki, Kentaroh
- Stephens, Graeme L.

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Droplets to Drops by Turbulent Coagulation

by

- Riemer, N.
- Wexler, A. S.

This study addresses two central problems in cloud microphysics. The first is the source of large droplets, which initiates the rapid production of warm rain. The second is the broadening of the cloud droplet spectrum at both tails of the spectrum. The study explores how in-cloud turbulence can help to close the gaps in our understanding. With box model simulations, the development of cloud droplet spectra is calculated using a coagulation kernel that recently has been derived from direct numerical simulations. This kernel includes both the effect of turbulence on the relative velocities of the droplets and on the local increases in droplet concentration, the so-called accumulation effect. Under the assumption that this kernel can be extrapolated to atmospheric Reynolds numbers, the results show that for typical atmospheric conditions, the turbulent coagulation kernel is several orders of magnitude larger than the sedimentation kernel for droplets smaller then 100 μm. While for calm air after 30-min simulation time, only 7% of the total mass is found in droplets with sizes over 100 μm, this increases to 79% for a dissipation rate of 100 cm2 s−3 and 96% for 300 cm2 s−3 if a combined sedimentation and turbulent kernel is employed that assumes that the sedimentation and turbulent kernel can be added. Hence, moderate turbulence can enhance significantly the formation of large droplets. Furthermore, a time-scale analysis shows that broadening at the upper end of the spectrum is caused by turbulent coagulation whereas thermodynamic effects are responsible for broadening at the lower end.

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... S VOLUME 62 a vig- growth An of microphysical mechanisms. J. Appl. Meteor., 32, turbulence: An ex- **Cloud droplet growth by collection**. J. Atmos. the I: Broadening in adiabatic of coagula- de I: A method of pp. on cumulus cloud drople...

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adventures in atmospheric simulation

by

- G. M. Hidy

Laboratory investigations of processes related to atmospheric behavior have long been a resource of fundamental knowledge to workers in meteorology. In fact the history of progress in laboratory simulation closely follows the development of a wide spectrum of key ideas and hypotheses about the atmospheric processes on scales ranging from molecular activity to planetary circulation. This paper presents a very brief survey of the exciting wealth of information evolving from an ever increasing variety of laboratory experiments devoted to atmospheric phenomena.
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Postcrystalline deformation of the Pelona Schist bordering Leona Valley, southern California

by

- James George Evans

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Evolution of Raindrops in an Axisymmetric Cumulus Model

by

- Jun-ichi Shuno

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...小さい。このように両者の降水形成過程には顕著な相異が認められる。積雲モデルについては慎重な考察が加えられている。 **Berry, E. X**., 1967: Cloud droplet growth by col- lection. J. Atmos. Sci., 24, 688-701. Fletcher, N.H., 1962: Th...

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...hope and encouragement for the field and that substantial increased research funding is warranted.— **Edwin X Berry** (Continued from announcements, page 1453) A. McClatchey, AFCRL), with papers presented in the fol- ...

Environmental Research Division technical progress report, January 1984-December 1985

by

- Lab., Argonne National
- (USA), IL

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...thwest Laboratory for U.S. Nuclear Regulatory Commission. An analysis of cloud drop growth by 1974. **Berry, E.X**., and M. Reinhardt. Journal of Atmospheric Part IV; A new parameterziation. collection: Sciences 31...

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An explicit study of aerosol mass conversion and its parameterization in warm rain formation of cumulus clouds

by

- Sun, J.
- Fen, J.
- Ungar, R. K.

. The life time of atmospheric aerosols is highly affected by in-cloud scavenging processes. Aerosol mass conversion from aerosols embedded in cloud droplets into aerosols embedded in raindrops is a pivotal pathway for wet removal of aerosols in clouds. The aerosol mass conversion rate in the bulk microphysics parameterizations is always assumed to be linearly related to the precipitation production rate, which includes the cloud water autoconversion rate and the cloud water accretion rate. The ratio of the aerosol mass concentration conversion rate to the cloud aerosol mass concentration has typically been considered to be the same as the ratio of the precipitation production rate to the cloud droplet mass concentration. However, the mass of an aerosol embedded in a cloud droplet is not linearly proportional to the mass of the cloud droplet. A simple linear relationship cannot be drawn between the precipitation production rate and the aerosol mass concentration conversion rate. In this paper, we studied the evolution of aerosol mass concentration conversion rates in a warm rain formation process with a 1.5-dimensional non-hydrostatic convective cloud and aerosol interaction model in the bin microphysics. We found that the ratio of the aerosol mass conversion rate to the cloud aerosol mass concentration can be statistically expressed by the ratio of the precipitation production rate to the cloud droplet mass concentration with an exponential function. We further gave some regression equations to determine aerosol conversions in the warm rain formation under different threshold radii of raindrops and different aerosol size distributions. more ▾

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Relationship between drizzle rate, liquid water path and droplet concentration at the scale of a stratocumulus cloud system

by

- Geoffroy, O.
- Brenguier, J.-L.
- Sandu, I.

. The recent ACE-2, EPIC and DYCOMS-II field experiments showed that the drizzle precipitation rate of marine stratocumulus scales with the cloud geometrical thickness or liquid water path, and the droplet concentration, when averaged over a domain typical of a GCM grid. This feature is replicated here with large-eddy-simulations using state-of-the-art bulk parameterizations of precipitation formation in stratocumulus clouds. The set of numerical simulations shows scaling relationships similar to the ones derived from the field experiments, especially the one

derived from the DYCOMS-II data set. This result suggests that the empirical relationships were not fortuitous and that they reflect the mean effect of cloud physical processes. Such relationships might be more suited to GCM parameterizations of precipitation from shallow clouds than bulk parameterizations of autoconversion, that were initially developed for cloud resolving models.
more ▾

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A Further Study of a CISK Mode Unaffected by Surface Friction

by

- Masanori Yamasaki

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Weather Modification A Theoretician's Viewpoint

by

- Young, Kenneth C.

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...reciates the extensive comments provided by an anonymous reviewer and the encouragement provided by **Edwin X. Berry**, who was the program manager for the National Hail Research Program at NSF. The author recognizes m...

An Experimental Study of the Microstructure of Shallow Orographic Cumuli with Precipitation

by

- Yoshio Sasyo
- Hiroshi Tokuue

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Effect of mixed-phase cloud on the chemical budget of trace gases: A modeling approach

by

- yoann long

...st results of an explicit electrical scheme in a 3D cloud resolving model. Atmos. Res., 76, 95-113. **Berry, E.X**., Reinhardt, R.L., 1974a. An analysis of cloud drops growth by collection: Part I. Double distribut...

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by

- Junichi Shiino

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A kinematic model for understanding rain formation efficiency of a convective cell

by

- Hao Fu
- Yihua Lin

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The Role of Gravity Waves in the Meso-.BETA.-Scale Cycle of Squall-Line Type Convective Systems

by

- KAWASHIMA, Masayuki

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Analytical three-moment autoconversion parameterization based on generalized gamma distribution

by

- Xie, Xiaoning
- Liu, Xiaodong

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Snow-induced buffering in aerosol–cloud interactions

by

- Takuro Michibata
- Kentaroh Suzuki
- Toshihiko Takemura

. Complex aerosol–cloud–precipitation interactions lead to large differences in estimates of aerosol impacts on climate among general circulation models (GCMs) and satellite retrievals. Typically, precipitating hydrometeors are treated diagnostically in most GCMs, and their radiative effects are ignored. Here, we quantify how the treatment of precipitation influences the simulated effective radiative forcing due to aerosol–cloud interactions (ERFaci) using a state-of-the-art GCM with a two-moment prognostic precipitation scheme that incorporates the radiative effect of precipitating particles, and we investigate how microphysical process representations are related to macroscopic climate effects. Prognostic precipitation substantially weakens the magnitude of ERFaci (by approximately 54 %) compared with the traditional diagnostic scheme, and this is the result of the increased longwave (warming) and weakened shortwave (cooling) components of ERFaci. The former is attributed to additional adjustment processes induced by falling snow, and the latter stems largely from riming of snow by collection of cloud droplets. The significant reduction in ERFaci does not occur without prognostic snow, which contributes mainly by buffering the cloud response to aerosol perturbations through depleting cloud water via collection. Prognostic precipitation also alters the regional pattern of ERFaci, particularly over northern midlatitudes where snow is abundant. The treatment of precipitation is thus a highly influential controlling factor of ERFaci, contributing more than other uncertain “tunable” processes related to aerosol–cloud–precipitation interactions. This change in ERFaci caused by the treatment of precipitation is large enough to explain the existing difference in ERFaci between GCMs and observations.
more ▾

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The Consistent Behavior of Tropical Rain: Average Reflectivity Vertical Profiles Determined by Rain Top Height

by

- Reuven H. Heiblum
- Ilan Koren
- Orit Altaratz
- Alexander B. Kostinski

Sixteen years of Tropical Rain Measuring Mission (TRMM) reflectivity profile data are collected for oceanic, continental, and island tropical regions within the boreal winter intertropical convergence zone (ITCZ). When sorted by the rain top height (RTH), a consistent behavior emerges where the average reflectivity profiles originating at different RTHs form non-

overlapping manifolds in the height–reflectivity space, excluding the brightband regions for stratiform type profiles. Based on reflectivity slope (dB Z km−1) profile characteristics and physical considerations, the profiles are divided into three classes: 1) cold profiles, which originate above the −20°C isotherm height and display convergence to a single reflectivity slope profile independent of RTH; 2) warm profiles, which originate below the 0°C isotherm height and display strong reflectivity slope dependence on RTH, with slope values per RTH linearly decreasing with decreased height; and 3) mixed profiles, which originate at the layer located in between the lowest cold rain and highest warm rain profiles and show a gradual transition from cold profile to warm profile reflectivity slope behavior. Stratiform type profiles show similarity for all regions. It is shown that the typical tropical stratiform cold rain profile can be simply parameterized given the temperature profile. Convective type profiles present larger interregional differences. Their deviation from the typical stratiform cold rain profile is used as a measure for convective intensity, where continental and island regions show larger deviations compared to oceanic ones.
more ▾

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Rain Initiation Time in Turbulent Warm Clouds

by

- Gregory Falkovich

A mean field model is presented that describes droplet growth resulting from condensation and collisions and droplet loss resulting from fallout. The model allows for an effective numerical simulation. The numerical scheme that is conservative in water mass and keeps accurate count of the number of droplets is applied, and the way in which the rain initiation time depends on different parameters is studied. In particular, it is shown that the rain initiation time depends nonmonotonically (has a minimum) on the number of cloud condensation nuclei. Also presented is a simple model that allows one to estimate the rain initiation time for turbulent clouds with an inhomogeneous concentration of cloud condensation nuclei. It is argued that by overseeding even a part of a cloud by small hygroscopic nuclei one can substantially delay the onset of precipitation.
more ▾

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Drizzle in Stratiform Boundary Layer Clouds. Part II: Microphysical Aspects

by

- Wood, R.

This is the second of two observational papers examining drizzle in stratiform boundary layer clouds. Part I details the vertical and horizontal structure of cloud and drizzle parameters, including some bulk microphysical variables. In this paper, the focus is on the in situ size-resolved microphysical measurements, particularly of drizzle drops (r &

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Stillwater Complex, Montana; structure, mineralogy, and petrology of the basal zone with emphasis on the occurrence of sulfides

by

- Norman J Page

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LIMA (v1.0): A quasi two-moment microphysical scheme driven by a multimodal population of cloud condensation and ice freezing nuclei

by

- B. Vié
- J.-P. Pinty
- S. Berthet
- M. Leriche

The paper describes the LIMA (Liquid Ice Multiple Aerosols) quasi two-moment microphysical scheme, which relies on the prognostic evolution of an aerosol population, and the careful description of the nucleating properties that enable cloud droplets and pristine ice crystals to form from aerosols. Several modes of cloud condensation nuclei (CCN) and ice freezing nuclei (IFN) are considered individually. A special class of partially soluble IFN is also introduced. These "aged" IFN act first as CCN and then as IFN by immersion nucleation at low temperatures.

 All the CCN modes are in competition with each other, as expressed by the single equation of maximum supersaturation. The IFN are insoluble aerosols that nucleate ice in several ways (condensation, deposition and immersion freezing) assuming the singular hypothesis. The scheme also includes the homogeneous freezing of cloud droplets, the Hallett–Mossop ice multiplication process and the freezing of haze at very low temperatures.

 LIMA

assumes that water vapour is in thermodynamic equilibrium with the population of cloud droplets (adjustment to saturation in warm clouds). In ice clouds, the prediction of the number concentration of the pristine ice crystals is used to compute explicit deposition and sublimation rates (leading to free under/supersaturation over ice). The autoconversion, accretion and self-collection processes shape the raindrop spectra. The initiation of the large crystals and aggregates category is the result of the depositional growth of large crystals beyond a critical size. Aggregation and riming are computed explicitly. Heavily rimed crystals (graupel) can experience a dry or wet growth mode. An advanced version of the scheme includes a separate hail category of particles forming and growing exclusively in the wet growth mode. The sedimentation of all particle types is included.

 The LIMA scheme is inserted into the Meso-NH cloud-resolving mesoscale model. The flexibility of LIMA is illustrated by two 2-D experiments. The first one highlights the sensitivity of orographic ice clouds to IFN types and IFN concentrations. Then a squall line case discusses the microstructure of a mixed-phase cloud and the impacts of pure CCN and IFN polluting plumes. The experiments show that LIMA responds well to the complex nature of aerosol–cloud interactions, leading to different pathways for cloud and precipitation formation.
more ▾

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Simulation of hydrometeor size spectra evolution by water-water, ice-water and ice-ice interactions

by

- Igor Sednev

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Simulations of marine stratocumulus using a new microphysical parameterization scheme

by

- Graham Feingold

...omparison among different one-dimensional codes and with LES. Bull. Am. Meteor. Soc. 77, 2033-2042. **Berry, E.X.**, 1967. Cloud droplet growth by coalescence. J. Atmos. Sci. 24, 688-701. Berry, E.X., Reinhardt, R....

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The Effect of Surface Friction on the Mesoscale Organization of Cumulus Convection in Tropical Cyclones

by

- Tomoe Nasuno
- Masanori Yamasaki

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...volution of the inflow boundary layer of Hurricane Gilbert (1988) . Mon. Wea. Rev., 123, 2348-2368. **Berry, E.X**., 1968: Modification of the warm rain pro- cess. Proc. First National Conf. Weather Modifica- tion,...

Understanding aerosol–cloud interactions through modeling the development of orographic cumulus congestus during IPHEx

by

- Ana Barros

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Impact of Drizzle-Sized Cloud Particles on Production of Precipitation in Hailstorms: A Sensitivity Study

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Role of sublimation and riming in the precipitation distribution in the Kananaskis Valley, Alberta, Canada

by

- Émilie Poirier
- Julie M. Thériault
- Maud Leriche

. The phase of precipitation and its distribution at the surface can affect water resources and the regional water cycle of a region. A field project was held in March–April 2015 on the eastern slope of the Canadian Rockies to document precipitation characteristics and associated atmospheric conditions. During the project, 60 % of the particles documented were rimed in relatively warm and dry conditions. Rain–snow transitions also occurred aloft and at the surface

in sub-saturated conditions. Ice-phase precipitation falling through a saturated atmospheric layer with temperatures > 0 ◦C will start melting. In contrast, if the melting layer is sub-saturated, the ice-phase precipitation undergoes sublimation, which increases the depth of the rain–snow transition. In this context, this study investigates the role of sublimation and riming in precipitation intensity and type reaching the surface in the Kananaskis Valley, Alberta, during March–April 2015. To address this, a set of numerical simulations of an event of mixed precipitation observed at the surface was conducted. This event on 31 March 2015 was documented with a set of devices at the main observation site (Kananaskis Emergency Services, KES), including a precipitation gauge, disdrometer, and micro rain radar. Sensitivity experiments were performed to assess the impacts of temperature changes from sublimation and the role of the production of graupel (riming) aloft in the surface precipitation evolution. A warmer environment associated with no temperature changes from sublimation leads to a peak in the intensity of graupel at the surface. When the formation of graupel is not considered, the maximum snowfall rate occurred at later times. Results suggest that unrimed snow reaching the surface is formed on the western flank and is advected eastward. In contrast, graupel would form aloft in the Kananaskis Valley. The cooling from sublimation and melting by rimed particles increases the vertical shear near KES. Overall, this study illustrated that the presence of graupel influenced the surface evolution of precipitation type in the valley due to the horizontal transport of precipitation particles.
more ▾

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エアロゾル粒子の粒度分布変化計算について

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How Much Human-Caused Global Warming Should We Expect with Business-As-Usual (BAU) Climate Policies? A Semi-Empirical Assessment

by

- Ronan Connolly
- Michael Connolly
- Robert M. Carter
- Willie Soon

In order to assess the merits of national climate change mitigation policies, it is important to have a reasonable benchmark for how much human-caused global warming would occur over the coming century with “Business-As-Usual” (BAU) conditions. However, currently, policymakers are limited to making assessments by comparing the Global Climate Model (GCM) projections of future climate change under various different “scenarios”, none of which are explicitly defined as BAU. Moreover, all of these estimates are ab initio computer model projections, and policymakers do not currently have equivalent empirically derived estimates for comparison. Therefore, estimates of the total future human-caused global warming from the three main greenhouse gases of concern (CO2, CH4, and N2O) up to 2100 are here derived for BAU conditions. A semi-empirical approach is used that allows direct comparisons between GCM-based estimates and empirically derived estimates. If the climate sensitivity to greenhouse gases implies a Transient Climate Response (TCR) of ≥ 2.5 °C or an Equilibrium Climate Sensitivity (ECS) of ≥ 5.0 °C then the 2015 Paris Agreement’s target of keeping human-caused global warming below 2.0 °C will have been broken by the middle of the century under BAU. However, for a TCR 1.5 °C or ECS 2.0 °C, the target would not be broken under BAU until the 22nd century or later. Therefore, the current Intergovernmental Panel on Climate Change (IPCC) “likely” range estimates for TCR of 1.0 to 2.5 °C and ECS of 1.5 to 4.5 °C have not yet established if human-caused global warming is a 21st century problem.
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HIGHLY CITED

Giant Sea-Salt Aerosols and Warm Rain Formation in Marine Stratocumulus

by

- Jensen, Jørgen B.
- Lee, Sunhee

The concentrations and sizes of smaller aerosols (radius smaller than 0.5 μm) in the marine atmosphere vary owing to natural and anthropogenic factors. The concentrations and sizes of giant and ultragiant aerosols vary primarily due to wind-speed-dependent wave breaking. In climate models the formation of warm rain from marine stratocumulus clouds is usually parameterized based on the drops that form on the smaller aerosols. The present process study, using a stochastic Monte Carlo cloud model, shows that the variability of giant sea-salt aerosols and the variability of smaller aerosol cloud condensation nuclei are equally important in determining precipitation flux in marine stratocumulus. This strongly suggests that the effects of giant sea-salt aerosols should be included in the parameterization of warm rain formation in climate and other large-scale models. The above results are based on highly detailed calculations of droplet growth in an idealized marine stratocumulus cloud; the authors believe that other marine stratus cloud conditions may change the calculated rain rates but that the conclusions regarding the relative importance of small and giant aerosols are robust.
more ▾

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A Numerical Study of Precipitation Development in Cumulus Clouds

by

- Junichi Shiino

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...E.X., 1967: Cloud droplet growth by col- lection. J. Atmos. Sci., 24, 688-701. ---------- , 1968 : **Modification of the warm rain process**. Proceedings of the First National Conference on Weather Modification, Albany, New York, April 28-M...

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A Theoretical Framework for Examining Geographical Variability in the Microphysical Mechanisms of Precipitation Development.

by

- David B. Johnson

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...recipitation in convective clouds. J. Meteor., 10, 311-324. Berry, E. X, and R. L. Reinhardt, 1974: **An analysis of cloud drop growth by collection: Part I. Double distributions**. J. Atmos. Sci., 31, 1814-1824. Hallett, J., and S. C. Mossop, 1974: Production of secondary ice pa...

Absorption et désorption du dioxyde de souffre par des gouttes d'eau de fort diamètre en chute.

by

- Lépinasse, E.
- Marion, M.

- Guella, S.
- Alexandrova, S.
- Saboni, A.

Cet article concerne l'absorption et la désorption du SO2 par des gouttes d'eau de diamètre supérieur à 1mm en chute libre dans un mélange air-SO2 à faible et moyenne concentrations. Dans ce cas, le transfert résulte du couplage des résistances interne et externe à la goutte. Dans la phase liquide, un modèle local basé sur la vitesse de frottement inter faciale et le diamètre de la goutte permet le calcul du coefficient de transfert interne kl. Le coefficient de transfert externe kg dans la phase gazeuse est déterminé à l'aide d'une expression plus classique Afin de valider le modèle, des investigations expérimentales sont menées en absorption et en désorption sur une colonne de 2.3 m de hauteur dans laquelle le temps de séjour des gouttes est de l'ordre de la seconde. Le présent modèle simule fort bien l'ensemble de ces expériences réalisées pour différents diamètres de goutte [2.04 ; 4.31] mm et différentes concentrations [100 ; 2000] ppm. Le modèle proposé est aussi comparé avec succès à des résultats expérimentaux de la littérature à faible et moyenne concentrations pour des temps de contact beaucoup plus grands. Son domaine d'application couvre donc désormais l'absorption et la désorption du SO2 pour des concentrations comprises entre quelques ppm et quelque %. more ▾

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A bulk parameterization of melting snowflakes with explicit liquid water fraction for the COSMO model version 4.14

by

- C. Frick
- A. Seifert
- H. Wernli

. A new snow melting parameterization is presented for the non-hydrostatic limited-area COSMO ("consortium for small-scale modelling") model version 4.14. In contrast to the standard cloud microphysics of the COSMO model, which instantaneously transfers the meltwater from the snow to the rain category, the new scheme explicitly considers the liquid water fraction of the melting snowflakes. These semi-melted hydrometeors have characteristics (e.g., shape and fall speed) that differ from those of dry snow and rain droplets. Where possible, theoretical considerations and results from vertical wind tunnel laboratory experiments of melting snowflakes are used as the basis for characterizing the melting snow as a function of its liquid water fraction. These characteristics include the capacitance, the ventilation coefficient, and the terminal fall speed. For the bulk parameterization, a critical diameter is introduced. It is assumed that particles smaller than this diameter, which increases during the melting process, have completely melted, i.e., they are converted to the rain category. The values of the bulk integrals are calculated with a finite difference method and approximatively represented by polynomial functions, which allows an efficient implementation of the parameterization. Two case studies of (wet) snowfall in Germany are presented to

illustrate the potential of the new snow melting parameterization. It is shown that the new scheme (i) produces wet snow instead of rain in some regions with surface temperatures slightly above the freezing point, (ii) simulates realistic atmospheric melting layers with a gradual transition from dry snow to melting snow to rain, and (iii) leads to a slower snow melting process. In the future, it will be important to thoroughly validate the scheme, also with radar data and to further explore its potential for improved surface precipitation forecasts for various meteorological conditions.
more ▾

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Understanding aerosol–cloud interactions through modelling the development of orographic cumulus congestus during IPHEx

by

- Anonymous

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Stochastic effects of cloud droplet hydrodynamic interaction in a turbulent flow

by

- Mark Pinsky

... 1993. Warm-rain initiation: an overview of microphysical mechanisms. J. Appl. Meteor. 32, 608–625. **Berry, E.X**., 1974. An analysis of cloud drop growth by collection: Part 1. Double distributions. J. Atmos. Sci...

Aerossóis, nuvens e clima: resultados do experimento LBA para o estudo de aerossóis e microfísica de nuvens

by

- Costa, Alexandre Araújo
- Pauliquevis, Theotonio

Os aerossóis atmosféricos respondem por uma das maiores incertezas na investigação dos cenários de mudança climática. A margem de erro associada às estimativas nas contribuições dos aerossóis no balanço energético global ainda é elevada, particularmente no que diz respeito ao chamado "efeito indireto". Ainda que o nível de compreensão científico, acerca do efeito indireto tenha avançado significativamente nos últimos anos, este ainda é muito baixo, quando comparado com o entendimento que se tem do papel dos gases de efeito estufa. Particularmente no Brasil, as medidas realizadas dentro do contexto LBA-SMOCC-EMfiN! (Large-Scale Biosphere-Atmosphere Experiment in Amazonia - Smoke Aerosols, Clouds, Rainfall and Climate - Experimento de Microfísica de Nuvens) possibilitaram uma base de dados ampla sobre aerossóis e microfísica de nuvens. Neste trabalho, apresentamos uma revisão de alguns dos principais resultados relacionados a essa base de dados, tanto via análise de resultados experimentais, quanto via modelagem numérica. Conclui-se que alterações significativas no processo de desenvolvimento da precipitação podem ocorrer em associação com a grande quantidade de aerossóis produzidos em queimadas, mas que diversas questões, principalmente referentes ao papel dos núcleos de condensação gigantes e núcleos de gelo ainda precisam ser elucidadas.
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The Nonhydrostatic ICosahedral Atmospheric Model for CMIP6 HighResMIP simulations (NICAM16-S): experimental design, model description, and impacts of model updates

by

- Chihiro Kodama
- Tomoki Ohno
- Tatsuya Seiki
- Hisashi Yashiro
- Akira T. Noda
- Masuo Nakano
- Yohei Yamada
- Woosub Roh

- Masaki Satoh
- Tomoko Nitta
- Daisuke Goto
- Hiroaki Miura
- Tomoe Nasuno
- Tomoki Miyakawa
- Ying-Wen Chen
- Masato Sugi

. The Nonhydrostatic ICosahedral Atmospheric Model (NICAM), a global model with an icosahedral grid system, has been under development for nearly two decades. This paper describes NICAM16-S, the latest stable version of NICAM (NICAM.16), modified for the Coupled Model Intercomparison Project Phase 6, High Resolution Model Intercomparison Project (HighResMIP). Major updates of NICAM.12, a previous version used for climate simulations, included updates of the cloud microphysics scheme and land surface model, introduction of natural and anthropogenic aerosols and a subgrid-scale orographic gravity wave drag scheme, and improvement of the coupling between the cloud microphysics and the radiation schemes. External forcings were updated to follow the protocol of the HighResMIP. A series of short-term sensitivity experiments were performed to determine and understand the impacts of these various model updates on the simulated mean states. The NICAM16-S simulations demonstrated improvements in the ice water content, high cloud amount, surface air temperature over the Arctic region, location and strength of zonal mean subtropical jet, and shortwave radiation over Africa and South Asia. Some long-standing biases, such as the double intertropical convergence zone and smaller low cloud amount, still exist or are even worse in some cases, suggesting further necessity for understanding their mechanisms, upgrading schemes and parameter settings, and enhancing horizontal and vertical resolutions.

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...nd application procedures are described in full detail in the August 2001 Bulletin (pp. 1689-1694). **EDWIN X BERRY**, Ph.D. Downloaded from http://journals.ametsoc.org/doi/pdf/10.1175/1520-0477-96.8.1426 by guest on...

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A Hybrid Bulk–Bin Approach to Model Warm-Rain Processes

by

- Grabowski, Wojciech W.
- Thouron, Odile
- Pinty, Jean-Pierre
- Brenguier, Jean-Louis

This paper presents a hybrid approach to model warm-rain processes, merging the diverse schemes of bulk and detailed (bin) microphysics. In the bulk scheme, the key assumption is that the exact saturation is maintained inside a cloud. In contrast, the supersaturation inside a cloud is predicted in the bin scheme and is applied to calculate the diffusional growth of cloud droplets. Predicting the supersaturation is numerically cumbersome, however, and typically requires spatial and temporal resolutions that are significantly higher than those that can be applied in the bulk scheme. At the same time, supersaturations inside clouds are small, and the condensate amounts in bulk and bin schemes differ insignificantly. This critical observation forms a starting point for the hybrid bulk–bin approach. In this approach, when the cloud water first appears, the activation scheme inserts cloud droplets at the low end of the bin representation. Subsequent diffusional and eventually accretional growth shift the spectrum toward larger sizes so that the saturation inside a cloud is maintained. Details of the hybrid approach are discussed in this paper, and the validation against the traditional bin scheme in a framework of the adiabatic rising parcel is presented. Before the scheme can be applied to the multidimensional cloud model, a 1D advection–condensation problem of Grabowski and Smolarkiewicz is used to address the issue of the numerical difficulties that finite-difference schemes experience near cloud edges. In the bulk case, these are in the form of condensation rate overshoots and undershoots; and this aspect requires special attention in the hybrid scheme. A novel approach is developed that provides a physically consistent solution near cloud edges using the hybrid bulk–bin scheme. The key is to allow grid boxes near the edges to be partly cloudy and to include spectral changes of cloud droplets that take this into account. Application of the hybrid scheme to an idealized 2D problem of moist thermal rising from rest and producing rain illustrates the application of the scheme to practical problems of cloud dynamics and warm-rain microphysics.
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How Often Does It Rain?

by

- Sun, Ying
- Solomon, Susan
- Dai, Aiguo
- Portmann, Robert W.

Daily precipitation data from worldwide stations and gridded analyses and from 18 coupled global climate models are used to evaluate the models&

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Relationship between drizzle rate, liquid water path and droplet concentration at the scale of a stratocumulus cloud system

by

- Geoffroy, O.
- Brenguier, J.-L.
- Sandu, I.

. The recent ACE-2, EPIC and DYCOMS-II field experiments showed that the drizzle precipitation rate of marine stratocumulus scales with the cloud geometrical thickness or liquid water path, and the droplet concentration, when averaged over a domain typical of a GCM grid. This feature is replicated here with large-eddy-simulations using state-of-the-art bulk parameterizations of precipitation formation in stratocumulus clouds. The set of numerical simulations shows scaling relationships similar to the ones derived from the field experiments, especially the one derived from the DYCOMS-II data set. This result suggests that the empirical relationships were not fortuitous and that they reflect the mean effect of cloud physical processes. Such relationships might be more suited to GCM parameterizations of precipitation from shallow clouds than bulk parameterizations of autoconversion, that were initially developed for cloud resolving models.
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Explicit Forecasts of Winter Precipitation Using an Improved Bulk Microphysics Scheme. Part II: Implementation of a New Snow Parameterization

by

- Thompson, Gregory
- Field, Paul R.
- Rasmussen, Roy M.
- Hall, William D.

A new bulk microphysical parameterization (BMP) has been developed for use with the Weather Research and Forecasting (WRF) Model or other mesoscale models. As compared with earlier single-moment BMPs, the new scheme incorporates a large number of improvements to both physical processes and computer coding, and it employs many techniques found in far more sophisticated spectral/bin schemes using lookup tables. Unlike any other BMP, the assumed snow size distribution depends on both ice water content and temperature and is represented as a sum of exponential and gamma distributions. Furthermore, snow assumes a nonspherical shape with a bulk density that varies inversely with diameter as found in observations and in contrast to nearly all other BMPs that assume spherical snow with constant density. The new scheme's snow category was readily modified to match previous research in sensitivity experiments designed to test the sphericity and distribution shape characteristics. From analysis of four idealized sensitivity experiments, it was determined that the sphericity and constant density assumptions play a major role in producing supercooled liquid water whereas the assumed distribution shape plays a lesser, but nonnegligible, role. Further testing using numerous case studies and comparing model results with in situ and other observations confirmed the results of the idealized experiments and are briefly mentioned herein, but more detailed, microphysical comparisons with observations are found in a companion paper in this series (Part III, forthcoming).
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Aerosol effects on clouds and precipitation during the 1997 smoke episode in Indonesia

by

- H.-F. Graf
- J. Yang
- T. M. Wagner

. In 1997/98 a severe smoke episode due to extensive biomass burning, especially of peat, was observed over Indonesia. September 1997 was the month with the highest aerosol burden. This month was simulated using the limited area model REMOTE driven at its lateral boundaries by ERA40 reanalysis data. REMOTE was extended by a new convective cloud parameterization mimicking individual clouds competing for instability energy. This allows for the interaction of

aerosols and convective clouds and precipitation. Results show that convective precipitation is diminished at all places with high aerosol loading, but at some areas with high background humidity precipitation from large-scale clouds may over-compensate the loss in convective rainfall. At individual time steps, very few cases were found when polluted convective clouds produced intensified rainfall via mixed phase microphysics. However, these cases are not unequivocal and opposite results were also simulated, indicating that other than aerosol-microphysics effects have important impact on the results. Overall, the introduction of the new cumulus parameterization and of aerosol-cloud interaction improved the simulation of precipitation patterns and total amount.
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Colorado Plowable Hailstorms: Synoptic Weather, Radar, and Lightning Characteristics

by

- Kalina, Evan A.
- Friedrich, Katja
- Motta, Brian C.
- Deierling, Wiebke
- Stano, Geoffrey T.
- Rydell, Nezette N.

Synoptic weather, S-band dual-polarization radar, and total lightning observations are analyzed from four thunderstorms that produced “plowable” hail accumulations of 15–60 cm in localized areas of the Colorado Front Range. Results indicate that moist, relatively slow (5–15 m s−1) southwesterly-to-westerly flow at 500 hPa and postfrontal low-level upslope flow, with 2-m dewpoint temperatures of 11°–19°C at 1200 LST, were present on each plowable hail day. This pattern resulted in column-integrated precipitable water values that were 132%–184% of the monthly means and freezing-level heights that were 100–700 m higher than average. Radar data indicate that between one and three maxima in reflectivity Z (68–75 dBZ) and 50-dBZ echo-top height (11–15 km MSL) occurred over the lifetime of each hailstorm. These maxima, which imply an enhancement in updraft strength, resulted in increased graupel and hail production and accumulating hail at the surface within 30 min of the highest echo tops. The hail core had Z ~ 70 dBZ, differential reflectivity ZDR from 0 to −4 dB, and correlation coefficient ρHV of 0.80–0.95. Time–height plots reveal that these minima in ZDR and ρHV gradually descended to the surface after originating at heights of 6–10 km MSL ~15–60 min prior to accumulating hailfall. Hail accumulations estimated from the radar data pinpoint the times and locations of plowable hail, with depths greater than 5 cm collocated with the plowable hail reports. Three of the four hail events were accompanied by lightning flash rates near the maximum observed thus far within the thunderstorm.
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Entrainment and droplet spectral characteristics in convective clouds during transition to monsoon

by

- Bera, Sudarsan
- Pandithurai, G.
- Prabha, Thara V.

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An experimental study on the drop/interface partial coalescence with surfactants

by

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- Weheliye Hashi Weheliye
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A Robust Numerical Solution of the Stochastic Collection–Breakup Equation for Warm Rain

by

- Ana Barros

The focus of this paper is on the numerical solution of the stochastic collection equation–stochastic breakup equation (SCE–SBE) describing the evolution of raindrop spectra in warm rain. The drop size distribution (DSD) is discretized using the fixed-pivot scheme proposed by Kumar and Ramkrishna, and new discrete equations for solving collision breakup are presented. The model is evaluated using established coalescence and breakup parameterizations (kernels) available in the literature, and in that regard this paper provides a substantial review of the relevant science. The challenges posed by the need to achieve stable and accurate numerical solutions of the SCE–SBE are examined in detail. In particular, this paper focuses on the impact of varying the shape of the initial DSD on the equilibrium solution of the SCE–SBE for a wide range of rain rates and breakup kernels. The results show that, although there is no dependence of the equilibrium DSD on initial conditions for the same ...
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...an Meteorological Society View publication stats V46N11A03 Berry, E. X., and R. J. Reinhardt, 1974: **An analysis of cloud drop growth by collection: Part I. Double distributions**. J. Atmos. Sci., 31, 1814-1824. Best, A. C., 1950: Empirical formulae for the terminal velocity of ...

Including the sub-grid scale plume rise of vegetation fires in low resolution atmospheric transport models

by

- Elaine Prins

...va Dias, M A. F.: Smoking rain clouds over the Amazon, Science, 303, 1342-1345, 2004. Berry, E. X.: **Modification of the warm rain process**, Preprints, 1st Natl. Conf. on Weather Modification, Am. Meteorol. Soc., Al- bany, NY, 81-88, 1968....

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RAIN SCAVENGING STUDIES. Progress Report No. 3.

by

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- Gatz, D.F.

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...ature of meteorological fluctua- tions in clouds. J. Applied Meteor., £, 61-71. Berry, E. X., 1967. **Cloud droplet growth by collection**. J. Atmos. Sci. 24, 688-701. Das, P. K., 1950. The growth of cloud droplets by coalescence. Indian ...

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A Simulation Approach to the Formation of Precipitation Particles Using the Monte Carlo Method

by

- E. Uchida
- S. Ohta

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...tion in turbulent up- draught. Proc. Int. Conf. Clond Physics, Toronto, 515-519. Berry, E.X., 1967: **Cloud droplet growth by collection**, J. A. S., 24, 688-701. Davenport, A.G., 1961: The spectrum of horizontal gustiness near the ground...

PLUVIUS: a generalized one-dimensional model of reactive pollutant behavior, including dry deposition, precipitation formation, and wet removal

by

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Entrainment, Mixing, and Microphysics in Trade-Wind Cumulus

by

- James Hudson
- Jorgen Jensen

...93: Warm-rain initia- tion: An overview of microphysical mechanisms. J. Appl. Meteor., 32, 608–625. **Berry, E.X**. and R.L. Reinhardt, 1974: An analysis of cloud drop growth by collection: Parts I–IV. J. Atmos. Sc...

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...n C. Kocmond, Cornell Aeronautical Laboratory, Inc., of Cornell University, Buffalo, N. Y. (20 min) **Cloud droplet growth by collection**. of Nevada, Reno, Nev. (20 min) E. X. Berry, Desert Research Institute, University Cloud seeding ex...

The sensitivity of simulated shallow cumulus convection and cold pools to microphysics

by

- Li, Zhujun
- Zuidema, Paquita
- Zhu, Ping
- Morrison, Hugh

The sensitivity of nested WRF simulations of precipitating shallow marine cumuli and cold pools to microphysical parameterization is examined. The simulations differ only in their use of two widely used double-moment rain microphysical schemes: the Thompson and Morrison schemes. Both simulations produce similar mesoscale variability, with the Thompson scheme producing more weak cold pools and the Morrison scheme producing more strong cold pools, which are associated with more intense shallow convection. The most robust difference is that the cloud cover and LWP are significantly larger in the Morrison simulation than in the Thompson simulation. One-dimensional kinematic simulations confirm that dynamical feedbacks do not mask the impact of microphysics. These also help elucidate that a slower autoconversion process along with a stronger accretion process explains the Morrison scheme’s higher cloud fraction for a similar rain mixing ratio. Differences in the raindrop

terminal fall speed parameters explain the higher evaporation rate of the Thompson scheme at moderate surface rain rates. Given the implications of the cloud-cover differences for the radiative forcing of the expansive trade wind regime, the microphysical scheme should be considered carefully when simulating precipitating shallow marine cumulus.
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Collection/aggregation algorithms in Lagrangian cloud microphysical models: rigorous evaluation in box model simulations

by

- Simon Unterstrasser
- Fabian Hoffmann
- Marion Lerch

Recently, several Lagrangian microphysical models have been developed which use a large number of (computational) particles to represent a cloud. In particular, the collision process leading to coalescence of cloud droplets or aggregation of ice crystals is implemented differently in various models. Three existing implementations are reviewed and extended, and their performance is evaluated by a comparison with well-established analytical and bin model solutions. In this first step of rigorous evaluation, box model simulations, with collection/aggregation being the only process considered, have been performed for the three well-known kernels of Golovin, Long and Hall. Besides numerical parameters, like the time step and the number of simulation particles (SIPs) used, the details of how the initial SIP ensemble is created from a prescribed analytically defined size distribution is crucial for the performance of the algorithms. Using a constant weight technique, as done in previous studies, greatly underestimates the quality of the algorithms. Using better initialisation techniques considerably reduces the number of required SIPs to obtain realistic results. From the box model results, recommendations for the collection/aggregation implementation in higher dimensional model setups are derived. Suitable algorithms are equally relevant to treating the warm rain process and aggregation in cirrus.
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...mos. Sci., 31, 1604-1614, doi:10.1175/1520- 0469(1974)031<1604:TEOCIA>2.0.CO;2, 1974. Berry, E. X.: **Cloud Droplet Growth by Collection**, J. Atmos. Sci., 24, 688-701, doi:10.1175/1520-0469(1967)024<0688:CDGBC>2.0.CO;2, 1967. Berry, E. ...

Cloud-droplet growth due to supersaturation fluctuations in stratiform clouds

by

- Xiang-Yu Li

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... Rogers, R.: A short course in cloud physics, Elsevier, 1996. 17 Berry, E. X. and Reinhardt, R. L.: **An analysis of cloud drop growth by collection: Part I. Double distributions**, Journal of the Atmospheric Sciences, 31, 1814-1824, 1974. Brandenburg, A.: Pencil Code, https://do...

The transport and redistribution of atmospheric gases in regions of frontal rain

by

- R. Rosset

...F (Reading, England), CCVR (Palaiseau, France, project n°1717), and M6t~orologie Nationale (Paris). **Berry, E.X**., and R.L. Reinhardt, 1973: Modeling of condensation and col- lection within clouds. Desert Res. In...

On Sedimentation and Advection in Multimoment Bulk Microphysics

by

- Mansell, Edward R.

In two-moment bulk microphysics schemes, the practice of using different weighted fall velocities for the various moments is known to lead to artificial growth in reflectivity values for fast-falling particles, particularly at the downward leading edge of a precipitation column. Two simple correction schemes that prevent these artifacts while still allowing some effects of size sorting are presented. The corrections are obtained by comparing particle number concentrations that result from two or three different sedimentation calculations. The corrections do not conserve particle number concentrations but do prevent spurious reflectivity growth automatically without the need to place ad hoc limits on mean particle size. Multimoment bulk microphysics schemes often have used inconsistent variables in terms of the appropriate advection equation (e.g., mass mixing ratio and particle number concentration). A brief review of consistent advection and turbulent mixing for such variables is presented to provide clarification.
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Does the threshold representation associated with the autoconversion process matter?

by

- Guo, H.
- Liu, Y.
- Penner, J. E.

. Different ad hoc threshold functions associated with the autoconversion process have been arbitrarily used in atmospheric models. However, it is unclear how these ad hoc functions impact model results. Here systematic investigations of the sensitivities of climatically-important properties: CF (cloud fraction), LWP (liquid water path), and AIE (aerosol indirect effect) to threshold functions have been performed using a 3-D cloud-resolving model. It is found that the effect of threshold representations is larger on instantaneous values than on daily averages; and the effect depends on the percentage of clouds in their transitional stages of converting cloud water to rain water. For both the instantaneous values and daily averages, the sensitivity to the specification of critical radius is more significant than the sensitivity to the of the threshold representation (as embodied in the relative dispersion of droplet size distribution) for drizzling clouds. Moreover, the impact of threshold representations on the AIE is stronger than that on CF and LWP.
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...ion of warm cloud microphysical conversion processes, Atmos. Res., 33, 193-206, 1994. Berry, E. X.: **Modification of the warm rain process**. Preprints, First National Conf. on Weather Modification, Amer. Meteor. Soc., Albany, NY, 81-88, 19...

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Numerical Simulation of a Tornado Generating Supercell

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- Proctor, Fred
- Ahmad, Nashat
- Duparcmeur, Fanny Limon

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Large-Eddy Simulation of Contrails

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- Chlond, Andreas

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Evolution of Raindrops in an Axisymmetric Cumulus Model

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- Jun-ichi Shiino

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...-496. Berry, E. X., 1967: Cloud droplet growth by collec- tion. J. A tmos. Sci., 24, 688-701. 1968: **Modification of the warm rain process**. Proceedings of the First National Con- ference on Weather Modification, Albany, New York, April 28...

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Deconstructing the precipitation susceptibility construct: Improving methodology for aerosol-cloud precipitation studies

by

- Graham Feingold

...on from satel- lite," J. Geophys. Res., 112, D16302, doi:10.1029/2007JD008841. Berry, E. X. (1968), **Modification of the warm rain process**. Proceedings of the First National Conference on Weather Modification, Albany, New York, 28 April t...

Models of Clouds, Precipitation and Storms

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- Flossmann, Andrea I

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Towards Understanding Cloud Response in Atmospheric GCMs: The Use of Tendency Diagnostics

by

- OGURA, T
- EMORI, S
- WEBB, M.J
- TSUSHIMA, Y
- YOKOHATA, T
- OUCHI, A. ABE
- KIMOTO, M

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User's manual for the cloud and scavenging module version 1. 2. [RADM]

by

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... Research Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina. **Berry, E. X**., and R. L Reinhardt. 1974. 11 An Analysis of Cloud Drop Growth by Collection." J. of Atmos. Sci. 3...

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The role of transition metal ions on HOx radicals in clouds: a numerical evaluation of its impact on multiphase chemistry

by

- Deguillaume, L.
- Leriche, M.
- Monod, A.
- Chaumerliac, N.

. A new modelling study of the role of transition metal ions on cloud chemistry has been performed. Developments of the Model of Multiphase Cloud Chemistry (M2C2; Leriche et al., 2001) are described, including the transition metal ions reactivity emission/deposition processes and variable photolysis in the aqueous phase. The model is then applied to three summertime scenarios under urban, remote and marine conditions, described by Ervens et al. (2003). Chemical regimes in clouds are analyzed to understand the role of transition metal ions on cloud chemistry and especially, on HxOy chemistry, which consequently influences the sulphur and the VOCs chemistry in droplets. The ratio of Fe(II)/Fe(III) exhibits a diurnal variation with values in agreement with the available measurements of Fe speciation. In the urban case, sensitivity tests with and without TMI chemistry, show an enhancement of OH concentration in the aqueous phase when TMI chemistry is considered.
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On the application of the classic Kessler and Berry schemes in Large Eddy Simulation models with a particular emphasis on cloud autoconversion, the onset time of precipitation and droplet evaporation

by

- Ghosh, S.
- Jonas, P. R.

. Many Large Eddy Simulation (LES) models use the classic Kessler parameterisation either as it is or in a modified form to model the process of cloud water autoconversion into precipitation. The Kessler scheme, being linear, is particularly useful and is computationally straightforward to implement. However, a major limitation with this scheme lies in its inability to predict different autoconversion rates for maritime and continental clouds. In contrast, the Berry formulation

overcomes this difficulty, although it is cubic. Due to their different forms, it is difficult to match the two solutions to each other. In this paper we single out the processes of cloud conversion and accretion operating in a deep model cloud and neglect the advection terms for simplicity. This facilitates exact analytical integration and we are able to derive new expressions for the time of onset of precipitation using both the Kessler and Berry formulations. We then discuss the conditions when the two schemes are equivalent. Finally, we also critically examine the process of droplet evaporation within the framework of the classic Kessler scheme. We improve the existing parameterisation with an accurate estimation of the diffusional mass transport of water vapour. We then demonstrate the overall robustness of our calculations by comparing our results with the experimental observations of Beard and Pruppacher, and find excellent agreement.Key words. Atmospheric composition and structure · Cloud physics and chemistry · Pollution · Meteorology and atmospheric dynamics · Precipitation
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Impact of hygroscopic CCN and turbulence on cloud droplet growth: A parcel-DNS approach

by

- Lulin Xue

...//doi.org/10.1175/1520-0469(1971)028<1455:awtiot>2.0.co;2, 1971. Berry, E. X. and Reinhardt, R. L.: **An Analysis of Cloud Drop Growth by Collection Part II. Single Initial Distributions**, Journal of the Atmospheric Sciences, 31, 1825-1831, https://doi.org/10.1175/1520-0469(1974)031<182...

Mathematical Aspects of Coagulation-Fragmentation Equations

by

- F. P. da Costa

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...finite system of raction-diffusion equations, Adv. Math. Sci. Appl., 7 (1997) 349-364. E. X. Berry, **A mathematical framework for cloud models**, J. Atmos. Sci., 26 (1969) 109-111. J. Bertoin, Random fragmentation and coagulation processes; Cam...

New RAMS cloud microphysics parameterization

by

- Jerry Harrington

...mparisons, Preprints, FIRE Cirrus Science Conf., June 14-17, 1993, Breckenridge, Colorado, pp. 5-8. **Berry, E.X**. and Reinhardt, R.L., 1974. An analysis of cloud drop growth by collection: Part IV. A New Parame- ...

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A Comparison of Continuous and Stochastic Methods for Modeling Rain Drop Growth in Clouds

by

- Rehan Siddiqui

Effects of stochastic coalescence and air turbulence on the size distribution of cloud droplets

by

- Lian-Ping Wang

An open question in warm rain process and precipitation formation is how rain forms in warm cumulus as rapidly as it has sometimes been observed. In general, the rapid growth of cloud droplets across the size gap from 10 to 50 μm in radius has not been fully explained. Three aspects related to the air turbulence and stochastic coalescence are considered here in an attempt to resolve this open question. The first is the enhanced geometric collision rates caused by air turbulence. The second is the effect of air turbulence on collision efficiencies. The third is stochastic fluctuations and correlations in the collision–coalescence process. Rigorous approaches are developed to address these issues. Preliminary results indicate that turbulence could shorten the time for drizzle formation to about a half of the time needed for the same growth process based on hydrodynamic–gravitational mechanism alone. To address the effect of stochastic correlations, we derive and validate a true stochastic coalescence equation. It is hoped that this new mean field equation will be useful in the future to improve the deterministic kinetic collection equation.
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Exploratory cloud-resolving simulations of boundary-layer Arctic stratus clouds

by

- Graham Feingold

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Microphysical relationships in warm clouds

by

- James Hudson

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Retrieval of the microphysical properties in a CASP storm by integration of a numerical kinematic model

by

- Isztar Zawadzki

The Influence of the Acoustic-electric Coalescence on Phase and Mass Transfer of Supercooled Drops

by

- Zlatko Vukovic

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A Monte Carlo Framework to Simulate Multicomponent Droplet Growth by Stochastic Coalescence

by

- Léster Alfonso

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On the parameterization of ice microphysics in a mesoscale a weather forecast model

by

- Gerhard Kramm

Numerical experiments with a 3-D-dimensional mesoscale cz weather forecast model are performed to investigate the sensitivity of the model to different parameters and the parameterized microphysics. The parameterization considers condensation and deposition of water vapor, sublimation, evaporation of both cloud water and rainwater, riming of ice crystals by cloud water, rainwater formation by autoconversion, accretion and melting as well as the sedimentation of rain and ice crystals. The results of the simulations are discussed on the basis

of the analysis, estimations of skill and uncertainty, satellite data as well as observed precipitation data. These results show that the dynamics of the troposphere and the cloud microphysics can be described more realistically and that the model performance can be improved if ice processes are included. It is substantiated by all of these simulations that the relative humidity and water substance mixing ratio fields were only strongly altered by turning off the ice phase or the riming process.
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Partial coalescence of drops at liquid interfaces

by

- Blanchette, François
- Bigioni, Terry P.

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A Microphysical Interpretation of Radar Reflectivity–Rain Rate Relationships

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- Steiner, Matthias
- Smith, James A.
- Uijlenhoet, Remko

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...pler radar analysis. J. Atmos. Oceanic Technol., 2, 468-471. Berry, E. X., and M. R. Pranger, 1974: **Equations for calculating the terminal velocities of water drops**. J. Appl. Meteor., 13, 108-113. Best, A. C., 1950a: Empirical formulae for the terminal velocity o...

The role of transition metal ions on HOx radicals in clouds: a numerical evaluation of its impact on multiphase chemistry

by

- Deguillaume, L.
- Leriche, M.
- Monod, A.
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Modeling springtime shallow frontal clouds with cloud-resolving and single-column models

by

- Kuan-man Xu
- Sam Iacobellis
- Yogesh Sud

...I: General de- scription and narrow rainbands, J. Atmos. Sci., 49, 2200 -2217. Berry, E. X. (1968), **Modification of the warm rain process**, in Proceedings of 1st National Conference on Weather Modification, pp. 81 -85, Am. Meteorol. Soc.,...

Parameterization of the Autoconversion Process. Part II: Generalization of Sundqvist-Type Parameterizations

by

- Liu, Yangang
- Daum, Peter H.
- McGraw, R.
- Wood, R.

Existing Sundqvist-type parameterizations, which only consider dependence of the autoconversion rate on cloud liquid water content, are generalized to explicitly account for the droplet concentration and relative dispersion of the cloud droplet size distribution as well. The generalized Sundqvist-type parameterization includes the more commonly used Kessler-type parameterization as a special case, unifying the two different types of parameterizations for the autoconversion rate. The generalized Sundqvist-type parameterization is identical with the Kessler-type parameterization presented in Part I beyond the autoconversion threshold, but exhibits a more realistic, smooth transition in the vicinity of the autoconversion threshold (threshold behavior) in contrast to the discontinuously abrupt transition embodied in the Kessler-type parameterization. A new Sundqvist-type parameterization is further derived by applying the expression for the critical radius derived from the kinetic potential theory to the

generalized Sundqvist-type parameterization. The new parameterization eliminates the need for defining the driving radius and for prescribing the critical radius associated with Kessler-type parameterizations. The two-part structure of the autoconversion process raises questions regarding model-based empirical parameterizations obtained by fitting simulation results from detailed collection models with a single function.
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...n of warm cloud micro- physical conversion processes. Atmos. Res., 33, 193-206. Berry, E. X., 1968: **Modification of the warm rain process**. Pre- prints, First National Conf. on Weather Modification, Albany, NY, Amer. Meteor. Soc., 81-88. ...

Climate Change Reconsidered 2009 Report

by

- Guivitor 10

We have reviewed the materials presented in the first two volumes of the Fourth Assessment—The Physical Science Basis and Impacts, Adaptation and Vulnerability—and we find them to be highly selective and controversial with regard to making future projections of climate change and discerning a significant human-induced influence on current and past climatic trends. Although the IPCC claims to be unbiased and to have based AR4 on the best available science, such is not the case. In many instances conclusions have been seriously exaggerated, relevant facts have been distorted, and key scientific studies have been omitted or ignored. We present support for this thesis in the body of this volume, where we describe and reference thousands of peer-reviewed scientific journal articles that document scientific or historical facts that contradict the IPCC's central claims, that global warming is man-made and that its effects will be catastrophic. Some of this research became available after the AR4's self-imposed deadline of May 2006, but much of it was in the scientific record that was available to, and should have been familiar to, the IPCC's editors.
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...Ted Gibbs Berlincourt, PhD Baruch Berman Louis Bernath, PhD Dave Berrier Lester P. Berriman Carl E. **Berry Edwin** X. Berry, PhD David J. Berryman Richard G. Berryman Georgw J. Bertuccelli Thomas E. Berty Bruce A. ...

A statistical–numerical aerosol parameterization scheme

by

- JP Chen

new modal aerosol parameterization scheme, the statistical–numerical aerosol parameterization (SNAP), was developed for studying aerosol processes and aerosol– cloud interactions in regional or global models. SNAP applies statistical fitting on numerical results to generate accurate parameterization formulas without sacrificing details of the growth kernel. Processes considered in SNAP include fundamental aerosol processes as well as processes related to aerosol–cloud interactions. Comparison of SNAP with numerical solutions, analytical solutions, and binned aerosol model simulations showed that the new method performs well,

with accuracy higher than that of the high-order numerical quadrature technique, and with much less computation time. The SNAP scheme has been implemented in regional air quality models, producing results very close to those using binned-size schemes or numerical quadrature schemes.
more ▾

...doi:10.5194/acp-8-7431-2008, 2008. **Berry, E**. X.: **Cloud droplet growth by collection**, J. Atmos. Sci., 24, Chen, J.-P., Tsai, T.-S., and Liu, S.-C.: Aerosol...

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The Rational Climate e-Book

by

- Patrice Poyet

This book addresses all aspects of climate and paleo-climates, from atmospheric physics, to astronomical influences and geological and geochemical drivers. It covers the computer models claiming to simulate the climate and the policies that are projected from them. This is the Final First Edition. If you like, recommend and make it known to others. Share as much as you can. Check regularly for updates. Poyet, P., 2021. The Rational Climate e-Book: Cooler is Riskier. The Sorry State of Climate Science and Policies. Final First Edition, April 19th, 125 Figures, 185 Equations, 473 pp., e-ISBN 978-99957-1-929-6, DOI: 10.13140/RG.2.2.28648.80640
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1 recommendation

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An investigation of methods for injecting emissions from boreal wildfires using WRF-Chem during ARCTAS

by

- walter sessions

...1986. doi:10.1175/2009WAF2222241.1, 2009. **Berry, E**. X.: **Modification of the warm rain process**, Preprints, 1st Dickerson , R. R., Li, C., Li, Z., Marufu, L.T., Stehr...

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chair report

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...Gerald Dittbernerwill replace Jack Ernst on the board. Because of unexpected demands on their time, **Edwin Berry** and Ray Hoxit reluctantly resigned from the BCCM and have been replaced by Jay Ganz and John Bradle...

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...rner A. Baxter, Robert A. Bealer, Alex W. Bedford, Christopher D. Beebe, Robert C. Bellamy, John C. **Berry, Edwin** X Biter, Cleon J. Bittle, Clifton R. Blackadar, Alfred K. Blatt, Michael Blewitt, Doug N. Block, Ja...

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...Bass, Arthur Baum, Werner A. Bealer, Alex W. Beckwith, W. Boynton Beebe, Robert G. Bellamy, John C. **Berry, Edwin** X Bittle, Clifton R. Blackadar, Alfred K. Blatt, Michael 309 340 358 170 167 191 103 198 474 186 3...

Numerical Experiments on the Relation Between Microphysics and Dynamics in Cumulus Convection

by

- MURRAY, F. W.
- KOENIG, L. R.

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...n stage," Journal of the Atmospheric Sciences, Vol. 25, No. 3, pp. 404-415. Berry, Edwin X , 1968: "**Modification of the warm rain process**," Proceedings of the First National Conference on Weather Modification, Albany, 28 April-1 May 1968...

HIGHLY CITED

NUMERICAL SIMULATION OF THE LIFE CYCLE OF A THUNDERSTORM CELL

by

- OGURA, YOSHIMITSU
- TAKAHASHI, TSUTOMU

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...Meteorological Society, Vol. 97, No. 412, London, England, Apr. 1971, pp. 242-248. Berry, Edwin X.,"**Cloud Droplet Growth by Collection**," J o u r n a l of the Atmospheric Sciences, Vol. 24, No. 6, Nov. 1967, pp. 688701. Berry, Edwin X....

Storm and Cloud Dynamics ACADEMIC PRESS, INC

by

- Ravi Bisht

...156-178. **Berry, E**. X. (1965). **Cloud droplet growth by collection**. Ph.D. Thesis, Univ. of Nevada. **Berry, E**. X. (1967). **Cloud droplet growth by collection**. J. Amos. Sci. 24, 688-701. **Berry, E**. X. (1968)...

ONE STRANGE ROCK - flashy mishmash demonizing sun, Co2 and fossil fuels. Will Smith states: "human Co2 60 times volcanoes." Wrong and irrelevant. Arrogant anti-science.

by

- James G Matkin

ONE STRANGE ROCK is a flashy, arrogant mishmass of simple mistruths and deceptions. Will Smith, demonizes Co2 and the sun saying, "Fossil fuels emit 60 times more Co2 than volcanos." NO, often the reverse and what about smoke from wild fires? The show is based on a distorted view that the sun and carbon dioxide and human emissions are the enemy. One Strange Rock ultimately has an identity crisis in what it wants to cover and how, and it ends up as a mishmash of stories, scripted vignettes, aerial footage, and conjecture. One of the most disappointing aspects is how events with multiple theories behind them (like the formation of our moon) are reduced to one theory reported as fact. James Matkin 30 Jul 2019 9:42AM The show is biased showing no humility about climate complexity and making misleading statistics. Eg. Smith demonizing life giving Co2 by saying there are 60 times more human emissions from fossil fuels than Co2 from volcanos. This is wrong and irrelevant as natural Co2 includes wild fires etc not just volcanos and the increase comes from rising temperatures not the other way around. Prof Selby summarizes the errors about Co2. Conclusion: the human contribution is in-distinguishable from the natural component!Future CO2 concentrations can only be marginally predicted. This conclusion is dynamite. If valid, all the CO2 scare of the last 20-30 years collapses, and with it all politics based on the assumption that human CO2 emissions are extremely dangerous and must be forcibly reduced as fast as possible to avoid climate disruption. Prof. Salby (a former IPCC contributor) stresses that the above considerations of the importance of natural CO2 emissions have been ignored in IPCC's AR4. Richard S. Courtney writes "the carbon cycle cannot be very sensitive to relatively small disturbances such as the present anthropogenic emissions of CO2" and "… it would appear that the relatively large increase of CO2 concentration in the atmosphere in the twentieth century (some 30%) is likely to have been caused by the increased mean temperature that preceded it. The main cause may be desorption from the oceans. [Co2 is our wonderful friend making all life possible like the sun not the enemy as Smith et al claim.] https://meteolcd.wordpress.com/2012/04/29/the-part-of-natural-co2-emissions-dynamite-conference-by-prof-murray-salby/ WHAT IS THE PERCENTAGE OF CO2 IN THE ATMOSPHERE INCLUDING DATA FOR FOSSIL FUEL EMISIONS? MINUSCULE Co2 is a minute, vital and non-toxic invisible gas at 0.039% of the atmosphere that makes photosynthesis possible. It is invisible and acts like the chemical reaction of a pinch salt making

food taste better - 6CO2+12H2O + Light → C6H12O6+ 6O2+ 6H2O. It is dwarfed by Nitrogen at 78.08% and Oxygen at 20.95% and is heavier than air does not mix well with other gases. A changing Atmosphere The components of the present atmosphere. The present atmosphere mostly consists of Nitrogen(78%), the second gas is Oxygen(21%) and the remainder was 0.9% Argon, 0.04% Carbon Dioxide. There are also traces of other gases. The Early atmosphere was almost all carbon dioxide when the Earth was formed. It has decreased to approximately 0.04% (the present percentage). Some of the carbon dioside dissolved into oceans. Some marine animals used this dissolved carbon dioxide to make calcium carbonate for their shells. When they die, these marine animals fell to the sea bed and then their shelss eventually formed limestone. The carbon that as locked up in the limestone, originally came from the atmosphere. https://work-to-study.fandom.com/wiki/A_changing_Atmosphere
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...Global Warming Science Published on September 13, 2018 90 Written by **Edwin Berry** BUSTED: Intergovernmental Panel on Climate Change (IPCC) simply assumes...

A Comprehensive Attack on Man-made Global Warming (AGW) .Many scientists refute AGW with facts, data and research and see AGW as a "psychological and social phenomenon backed by no solid scientific evidence."

by

- James G Matkin

Scientist #1 Refuting Manmade Global Warming: Dr. David Evans used to work for the Australian Greenhouse Office (the main modeler of carbon in Australia's biosphere) from 1999 to 2005. He has 6 degrees, including a PhD from Stanford in electrical engineering. Ev In 2012, Evans pointed out how the IPCC (the very political Intergovernmental Panel on Climate Change) models were flawed. These models are based on data sourced by NASA and Argo satellites, and assume that CO2 is the only warming agent. They fail to take into consideration other warming agents. He shows how the models, both for air and water, have consistently over-estimated, predicting warming that never happened. Evans shows data from Envisat (European satellites) which reveal how the sea level is rising 0.33 mm per year (3.3 cm per century), far below what the IPCC predicts (26-59 cm per century) and fearmonger Al Gore predicted (20 feet per century!). Evans compares the models vs. reality, and concludes: Money train: the manmade global warming or AGW movement is a gravy train. Scientist #2 Refuting Manmade Global Warming: Dr. Denis Rancourt Dr. Denis Rancourt believes that the idea that global warming, on its own, could negatively impart the environment, is tenuous at best. He describes manmade global warming as a psychological and social phenomenon backed by no solid scientific evidence. The problem is that the AGW movement has become a giant gravy train (estimated to be worth anywhere between $22 billion to $1.5 trillion per year). It's hard for scientists and politicians alike to get off such a comfortable and profitable moving vehicle, since their prestige, reputations and salaries all depend on it. Money train: the manmade global warming or AGW movement is a gravy train. He reveals how real activists understand that the AGW is not true activism, but rather an invention of the privileged world: "NGOs and environmental groups who agree to buy into the global warming thing benefit from it a lot, in the sense that the powerful interests … fund them. They have to pretend they are doing important research without ever criticizing powerful interests. They look for comfortable lies … they look for elusive, sanitized

things like acid rain, global warming … it helps to neutralize any kind of dissent … if you're really concerned about saving the forest, habitat destruction and so on, then fight against habitat destruction; don't go off into this tenuous thing about CO2 concentration …" If only the hijacked environmental movement could see the obvious: carbon dioxide is a nutrient, not a poison. Scientist #3 Refuting Manmade Global Warming: Freeman Dyson The 91-year-old mathematical physicist and scientist at Princeton University, Freeman Dyson, started studying the effects of carbon dioxide on vegetation 37 years ago! His work has shown how the increase in CO2 has been overall very beneficial for the Earth: "There are huge non-climate effects of carbon dioxide which are highly favorable … The whole Earth is growing greener as a result of carbon dioxide in the atmosphere, so it's increasing agricultural yields, forests and all kinds of growth in the biological world – and that's more important and more certain than the effects on climate. It's enormously important for food production … " Scientist #4 Refuting Manmade Global Warming: Dr. Judith Curry Dr. Judith Curry is Professor and former Chair of the School of Earth and Atmospheric Sciences at the Georgia Institute of Technology. We have been misled in our quest to understand climate change by not paying sufficient attention to natural causes of climate variability, in particular to the sun and from the long term oscillations and ocean circulations. How, then, and why, have climate scientists come to a consensus about a very complex scientific problem, that the scientists themselves acknowledge has substantial and fundamental uncertainties? Climate scientists have become entangled in an acrimonious political debate …" Carbon dioxide – not the enemy! (CO2 is the basis of the manmade global warming myth) Scientist #5 Refuting Manmade Global Warming: Professor & Nobel Laureate in Physics Ivar Giaever Professor Ivar Giaever, the 1973 Nobel Prizewinner for Physics, talks about how manmade global warming has become the new religion which cannot be challenged. He likens CO2 fearmongering to the story of the Emperor's new clothes. The purported 97% consensus and the hockey stick graphs are both utterly fake. He states that: "Global Warming is pseudoscience … from 1880 to 2013 the temperature has increased from ~288K to 288.8K (0.3%) … the temperature has been amazingly stable. Is it possible that all the paved roads and cut down forests are the cause of "global warming", not the CO2? CO2 is not pollution." Giaever also mentions the solution proposed by Steven Chu, former US Energy Secretary and 1997 Nobel Prize winder in Physics. Chu suggested painting all roof tops white – which would help reflect sunlight and lower warming, if in fact global warming is occurring. Dr. Don Easterbrook shows copious evidence to refute manmade global warming, by demonstrating that global cooling is in effect. Scientist #6 Refuting Manmade Global Warming: Dr. Don Easterbrook While the above 5 scientists believe there is some kind of global warming occurring (manmade or not), the following 5 scientists refute AGW by claiming the world is undergoing global cooling. Dr. Don Easterbrook (in his presentation of 2013), Professor Emeritus of Geology at Western Washington University, exposes how the data has been tampered with (by NASA, NOAA and the National Science Foundation). He points out that: – all high temperature records were set in 1930s before the rise of CO2; – global cooling has been in effect since 1998, according to ground and satellite measurements; – both the Arctic and Antarctic ice sheets are growing; – CO2 is incapable of causing global warming (given that it constitutes 38/1000th of 1 percent of atmospheric gases); – there is no correlation between CO2 and temperature; – CO2 follows temperature rather than preceding or causing it; – the sea level is rising (Seattle in specific) and falling (US Pacific Northwest in general) depending on where you are, and that the sea is rising at a very slow and constant rate; – extreme weather (such as hurricanes) has not increased; – snowfall has increased across the US; and – that the oceans are still very alkaline (pH 8.2) not acidic. Scientist #7 Refuting Manmade Global Warming: Meteorologist & Physicist Piers Corbyn Meteorologist and physicist Piers Corbyn, brother of UK Labour leader Jeremy Corbyn, claims the world is cooling. He states outright that "there is no such thing as manmade climate

change“. He also states that “the truth is the IPCC of the UN is a political not a scientific body, and it even amends scientific documents before publication to conform to diplomatic niceties.” The scientists are politically appointed to the IPCC. Corbyn explains that “science” as we think of it gets so entrenched in its current thinking that it’s often difficult for new theories or more accurate explanations to break through the status quo. As esteemed scientist Max Planck once said: “A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it.” This Aussie cartoon depicts how the manmade global warming scam works all over the world. Credit: Steve Hunter. Scientist #8 Refuting Manmade Global Warming: Professor and Geologist Bob Carter Former Professor and marine geologist Bob Carter points out that 280 ppm (parts per million) of carbon dioxide in the atmosphere, or even 390 or 560 ppm, is suboptimal for plant growth. There could be way higher levels and it still wouldn’t be anything like “dangerous”! In this presentation on climate change, he exposes how kids are being trained to spy on their parent’s energy usage and become “climate cops”, and how the UN predicted 50 million “climate refugees” by 2010 (whoops!!). Interestingly, although he is Australian, Carter quotes the former US President Eisenhower in his famous farewell speech to show how Government money corrupts honest science and free, critical thinking: “Akin to, and largely responsible for the sweeping changes in our industrial-military posture, has been the technological revolution during recent decades. In this revolution, research has become central; it also becomes more formalized, complex, and costly. A steadily increasing share is conducted for, by, or at the direction of, the Federal government. John Casey provides evidence of sun-driven global cooling, and shows that manmade global warming is nonsense. Scientist #9 Refuting Manmade Global Warming: Engineer & Former White House Advisor John Casey John Casey is a former White House national space policy advisor, NASA headquarters consultant, space shuttle engineer and author. He wrote the book Cold Sun which contains his research into global cooling. Casey investigated solar activity and concluded that we are now in a solar cycle or phase which could will lead to global cooling, not global warming, for the next 30 years to come. He claims this new cold climate will have a severe and dangerous affect on the world. In Cold Sun he provides evidence for the following: – the end of global warming; Scientist #10 Refuting Manmade Global Warming: Meteorologist John Coleman Meteorologist John Coleman has studied the facts about global warming and asserts that the data shows we are not undergoing global warming, manmade or not.
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...from near ground measurements at non-mixed environments”), see http://www.biomind.de/realCO2/ for more from Mr. Beck, Biesheim, France **Edwin Berry**, PhD (Atmospheric Physics, Nevada), MA (Physics...

Drop size modification by forest canopies: Measurements using a disdrometer

by

- Hall, Robin L.
- Calder, Ian R.

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Equations for Calculating the Terminal Velocities of Water Drops

by

- Edwin X Berry

Weather modification

by

- Grant, Lewis O.
- Cotton, William R.

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The Airflow Within the Weak Echo Region of an Alberta Hailstorm
by

- Edwin X Berry

Clima, energia e políticas públicas (F).pdf

by

- Demétrio Alves

...Limburg, Francois Gervais, Christopher Monckton, Ray Garnett, Madhav Khandekar, **EdwinBerry**, Karl Zeller e Ned Nikolov, Thomas Wysmuller, Benoit Rittaud, Conor...

Dust devil formation

by

- Barcilon, Albert
- Drazin, Philip G.

This mention was found in a paper hosted outside of Academia.edu

Convective Motion as Indicated by Visual Tracers
by

- Edwin X Berry

Clima energia e politicas publicas

by

- Demétrio Alves

This article does not aim to analyze the scientific credibility of the correlation between the multiple planetary phenomena considered as exponents of climate change and the anthropogenic emissions of carbon dioxide considered as its fundamental determinant.

However, the binomial, which has served as a canon for the political and economic activities of a wide range of governments, international organizations and corporate corporations, should merit, for its immediate and mediate importance to humanity, a broad technical-scientific debate., energia e políticas públicas
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..., investigador e professor sueco, Maria da Assunção Araújo – Professora da FLUP, Pamela Matlack-Klein, Michael Limburg, Francois Gervais, Christopher Monckton, Ray Garnett, Madhav Khandekar, **Edwin Berry**, Karl...

Coastal erosion: the case of the beaches of Vila Nova de Gaia. Consequences of the waste-water outlet, from Gaia littoral treatment plant)

by

- Maria A Araújo
- Viriato M. da SILVA

Among the cases of damage caused by human intervention, the Waste-water Treatment Plant, Gaia Litoral, was inaugurated in 2003, which has an underwater extension of 2.5 km, with its final effluent discharged into the sea at a depth of 30 meters.The block protection to the effluent outlet initiated a strong beach erosion to the south of Madalena beach, and even before the inauguration of waste water plan, in 31/December 1998, a restaurant called Titanic, 3700 meters to the south of the waste-water outlet was partially destroyed at Francelos beach. So, as a conclusion: the combined effect of dam sediment retention and anthropogenic works interfering in littoral drift seems much more important than the sea level rise that is quite small - if existent – in this area of Portuguese coastline.
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...temperature feedback 15.10 Camille Veyres: Eleven facts you must know to avoid being deceived by the AGW 15.30 **Edwin Berry**: A fatal flaw in global warming science 15.50 Hermann Harde: How...

WHAT IS THE CONSENSUS ON CLIMATE CHANGE IF NOT 97%? New book reveals UN threatened dismissal of working scientists who concluded: "No study to date has positively attributed all or part (of observed climate change) to anthropogenic (i.e. man-made) causes."

by

- James G Matkin

Sadly politics trumps science in the manmade global warming debate and a key factor is "FALSELY CLASSIFIED PAPERS" claiming 97% science support constantly repeated even by President Obama, yet replete with serious misrepresentations uncovered by Popular Trends and Technology" Co "The paper, Cook et al. (2013) 'Quantifying the consensus on anthropogenic global warming in the scientific literature' searched the Web of Science for the phrases "global warming" and "global climate change" then categorizing these results to their alleged level of

endorsement of AGW. These results were then used to allege a 97% consensus on human-caused global warming. POPULAR TECHNOLOGY writer interviewed a sample who quickly disavowed the claims made by Cook et al including Craig D. Idso Ph.D. Geography Chairman, Center for the Study of Carbon Dioxide and Global Change, Nicola Scafetta Ph.D. Physics Research Scientist, ACRIM Science Team,Ph.D. Astrophysics Associate Professor, Racah Institute of Physics, The Hebrew University of Jerusalem Nir J. Shaviv, Dr. Richard S.J. Tol Ph.D. Economics Professor of the Economics of Climate Change, Vrije Universiteit, Willie Soon Ph.D. Rocket Science Astrophysicist and Geoscientist, Harvard-Smithsonian Center for Astrophysics and other all denying Cook's analysis with scathing comments. For example, Dr. Morner, your paper 'Estimating future sea level changes from past records' is categorized by Cook et al. (2013) as having; "No Position on AGW". Is this an accurate representation of your paper? Morner: "Certainly not correct and certainly misleading. The paper is strongly against AGW, and documents its absence in the sea level observational facts. Also, it invalidates the mode of sea level handling by the IPCC." Further the Global Warming Policy Foundation published more attacks on the reliability of 97% supposed support titled: “FRAUD, BIAS AND PUBLIC RELATIONS The 97% ‘consensus’ and its critics.” Andrew Montford. The Global Warming Policy Foundation Recent reports that 97% of published scientific papers support the so-called consensus on Precisely what consensus is allegedly being supported in these papers cannot be discerned from the text of the paper. An analysis of the methodology used by Cook et al. shows that the consensus referred to is trivial: • that carbon dioxide (CO2) is a greenhouse gas • that human activities have warmed the planet to some unspecified extent. Almost everybody involved in the climate debate, including the majority of scepticsaccepts these propositions, so little can be learned from the Cook et al. paper. Numerous critiques of the paper have been published, some by supporters of main- stream views on climate science. These have demonstrated substantial biases in the methodology. Cook has certainly misrepresented what his research shows. More im- portantly, one researcher has made an allegation of scientific fraud, at this point unrebutted by Cook and his colleagues. Here is an example by Dr. Richard Tol voicing damning view of the study - Still without access to Cook’s data, Richard Tol had to publish his comment without having completed his analysis. However, there were still many issues that could be addressed. Unfortunately, Environmental Research Letters would not publish the critique and it appeared in another journal Tol, RSJ. ‘Quantifying the consensus on anthropogenic global warming in the literature: A re-analysis’. Energy Policy 2014; 73: 701–705. Tol explained some of the problems with Cook’s work. 1. Reported results are inconsistent and biased. The sample is not representative and contains many irrelevant papers. Overall, data quality is low. Cook’s validation test shows that the data are invalid. Data disclosure is incomplete so that key results cannot be reproduced or tested. Reality is "a majority of scientists are skeptical of global warming crisis." FORBES http://www.forbes.com/sites/jamestaylor/2013/02/13/peer-reviewed-survey-finds-majority-of-scientists-skeptical-of-global-warming-crisis/#1056f688171b It is of course absurd to suggest that papers that were categorised as not quantifying the extent of human influence could be said to endorse the idea that most of the warming was manmade. Cook’s response was followed by a rejoinder from Tol - [Tol, RSJ. ‘Quantifying the consensus on anthropogenic global warming in the literature: Rejoinder’. Energy Policy 2014; 73; 709.] which suggested that it was possible to demonstrate confirmation bias in the ratings. In the light of the release of Cook’s data, Tol has made further attempts to persuade Environmental Research Letters to publish a comment, but the journal has so far failed to respond. …http://www.thegwpf.org/content/uploads/2014/09/Warming-consensus-and-it-critics1.pdf more ▾

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...level from near ground measurements at non-mixed environments"), see http://www.biomind.de/realCO2/ for more from Mr. Beck, Biesheim, France **Edwin Berry**, PhD (Atmospheric Physics, Nevada), MA...

A numerical study of thunderstorm electrification: Model development and case study

by

- Kent Norville

..., pp. 114-130, edited by P. Krider and R. G. Roble, National Academy Press, Washington, D.C., 1986. **Berry, E. X**., and M. R. Pranger, Equations for calculating the termipad velocities of water drops, J. Appl. Met...

Equations for Calculating the Terminal Velocities of Water Drops
by

- Edwin X Berry

Cloud physics

by

- Hallett, J.
- Orville, H. D.
- Sartor, D.
- Weickmann, H. K.

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Sea Salt Aerosol Production: Mechanisms, Methods, Measurements and Models—A Critical Review

by

- Lewis, R.
- Schwartz, E.

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The Structure and Mechanisms of Hailstorms

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- Browning, K. A.

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Implementation of a two-moment bulk microphysics scheme to the WRF model to investigate aerosol-cloud interaction

by

- yuan wang

...D15211 B3. Curve-Fit to Detailed Model Simulations **Berry**, **E**. X., and R. L. Reinhardt (1974), **An analysis of cloud drop growthby collection**. **part II**: **Single initial distributions**, J...

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A Study of the Aerosol Effect on a Cloud Field with Simultaneous Use of GCM Modeling and Satellite Observation

by

- Akiko Higurashi

The indirect effect of aerosols was simulated by a GCM for nonconvective water clouds and was compared with remote sensing results from the Advanced Very High Resolution Radiometer (AVHRR) satellite-borne sensor for January, April, July, and October of 1990.The simulated global distribution of cloud droplet radius showed a land sea contrast and a characteristic feature along the coastal region similar
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Effect of Aerosol on the Susceptibility and Efficiency of Precipitation in Warm Trade Cumulus Clouds

by

- Graham Feingold

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Aerosol distributions and radiative forcing over the Asian Pacific region simulated by Spectral Radiation-Transport Model for Aerosol Species (SPRINTARS)

by

- Nobuo Sugimoto

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- Sandra Yuter

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1974 **Equations for calculating the terminal velocities of water drops**. J...

Effects of atmospheric particle concentration on cloud microphysics over Arecibo

by

- Shikha Raizada

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Turbulence effects on the collision kernel. II: Increase of the swept volume of colliding drops

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- Mark Pinsky

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Sensitivity experiments on the orographic snowfall over the mountainous region of northern Japan

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- Kazuo Saito

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by

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Numerical methods and calculations for droplet flow, heating and ignition

by

- Harry Dwyer
- David Dandy

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Another Look at Stochastic Condensation for Subgrid Cloud Modeling: Adiabatic Evolution and Effects

by

- Jon Reisner

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Modeling springtime shallow frontal clouds with cloud-resolving and single-column models

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- Sam Iacobellis

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An investigation of methods for injecting emissions from boreal wildfires using WRF-Chem during ARCTAS

by

- Ralph Kahn

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Aerosol indirect effects – general circulation model intercomparison and evaluation with satellite data

by

- Leo Donner

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Observations of microphysics pertaining to the development of drizzle in warm, shallow cumulus clouds

by

- Jeffrey French

.... J. Appl. Meteoml., 32,608-625 **Berry**, **E**. X. and Reinhardt, R. L. 1974 **An analysis of cloud drop growth by collection**. **Part I**: **Doubledistributions**. J...

LEADING SCIENTISTS, including 60 Nobel winners, doubt trace amounts of Co2 emissions cause over heated climate. New Research shows "extreme value of CO2 to all life forms, but no role in any change of the Earth’s climate." Alarmism "statistically questionable."

by

- James G Matkin

Following the death of Fidel Castro, it's perhaps a good time to think about the devastation of totalitarian government, and the damage that political agendas can do to science. The term Lysenkoism can also be used metaphorically to describe the manipulation or distortion of the scientific process. Sadly the history of the climate alarmist debates led by Al Gore is too much based on manipulation and distortion of data. Fortunately there are many leading climate scientists (often retired) who refuse to compromise data in a crusade against fossil fuels. "Let's be clear: the work of science has nothing whatever to do with consensus. Consensus is the business of politics. Science, on the contrary, requires only one investigator who happens to be right, which means that he or she has results that are verifiable by reference to the real world. In science consensus is irrelevant. What is relevant is reproducible results. The greatest scientists

in history are great precisely because they broke with the consensus..." - Michael Crichton, A.B. Anthropology, M.D. Harvard "CO2 for different people has different attractions. After all, what is it? - it's not a pollutant, it's a product of every living creature's breathing, it's the product of all plant respiration, it is essential for plant life and photosynthesis, it's a product of all industrial burning, it's a product of driving – I mean, if you ever wanted a leverage point to control everything from exhalation to driving, this would be a dream. So it has a kind of fundamental attractiveness to bureaucratic mentality." - Richard S. Lindzen, Ph.D. Professor Emeritus of Atmospheric Science, MIT 'Propaganda': Top MIT Climate Scientist Trashes '97% Consensus' Claim Dr. Richard Lindzen is sick and tired of the media repeating the so-called "97 percent consensus" statistic to show just how strong the global warming agreement is among climate scientists. It's purely "propaganda," argues Lindzen. "It was the narrative from the beginning," Lindzen, a climatologist at the Massachusetts Institute of Technology (MIT), told RealClear Radio Hour host Bill Frezza Friday. "In 1998, [NASA's James] Hansen made some vague remarks. Newsweek ran a cover that says all scientists agree. Now they never really tell you what they agree on." "It is propaganda," Lindzen said. "So all scientists agree it's probably warmer now than it was at the end of the Little Ice Age. Almost all Scientists agree that if you add CO2, you will have some warming. Maybe very little warming." "But it is propaganda to translate that into it is dangerous and we must reduce CO2," he added. Lindzen if referring to the often cited statistic among environmentalists and liberal politicians that 97 percent of climate scientists agree human activities are causing the planet to warm. This sort of argument has been around for decades, but recent use of the statistic can be traced to a 2013 report by Australian researcher John Cook. Cook's paper found of the scientific study "abstracts expressing a position on [manmade global warming], 97.1% endorsed the consensus position that humans are causing global warming." But Cook's assertion has been heavily criticized by researchers carefully examining his methodology. A paper by five leading climatologists published in the journal Science and Education found only 41 out of the 11,944 published climate studies examined in Cook's study explicitly stated mankind has caused most of the warming since 1950 — meaning the actual consensus is 0.3 percent. "It is astonishing that any journal could have published a paper claiming a 97% climate consensus when on the authors' own analysis the true consensus was well below 1%," said Dr. David Legates, a geology professor at the University of Delaware and the study's lead author. A 2013 study by Andrew Montford of the Global Warming Policy Foundation found that Cook had to cast a wide net to cram scientists into his so-called consensus. To be part of Cook's consensus, a scientific study only needed to agree carbon dioxide is a greenhouse gas and that human activities have warmed the planet "to some unspecified extent" — both of which are uncontroversial points. "Almost everybody involved in the climate debate, including the majority of sceptics, accepts these propositions, so little can be learned from the Cook et al. paper," wrote Montford. "The extent to which the warming in the last two decades of the twentieth century was man-made and the likely extent of any future warming remain highly contentious scientific issues." Despite the dubious nature of the consensus, liberal politicians used the figure to bolster their calls for policies to fight global warming. President Barack Obama even cited the Cook paper while announcing sweeping climate regulations. "Ninety-seven percent of scientists, including, by the way, some who originally disputed the data, have now put that to rest," Obama said in 2013, announcing his new global warming plan. "They've acknowledged the planet is warming and human activity is contributing to it." Lindzen disagreed with politicians who cite Cook's paper to call for stricter energy regulations. He said it's part of a political machine that's used by scientists and politicians to direct more taxpayer dollars to pet projects. "If you can make an ambiguous remark and you have people who will amplify it 'they said it not me' and he response of the political system is to increase your funding, what's not to like?" Lindzen said. "If I look

through my department, at least half of them keep mum. Just keep on doing your work, trying to figure out how it works," he said. http://dailycaller.com/2016/02/16/propoganda-top-mit-climate-scientist-trashes-97-consensus-claim/ _____ hope to demonstrate through this video, scientific evidence of why: The Ice Melting The sea is rising Hurricanes are blowing It is a true or lie? All this exists and has existed long ago, the changes are completely normal, because nothing is stable. Just as there are warm season, there is also the cold. Just remenber: The Little Ice Age (LIA) was a period of cooling that occurred after a warmer era known as the Medieval Warm Period. You can read all this in this page: http://en.wikipedia.org/wiki/Little_I... This 2007 documentary blows the whistle on what may be the biggest swindle in modern history. Proponents of man-made global warming (led by Al Gore) warn that climate change is the greatest threat ever to mankind, and if we do not change our ways and reduce CO2 emissions, polar ice caps will melt, coastal areas will flood and hurricanes like Katrina will become common. With nearly Gestapo like tactics, we are commanded not to question the edicts of the IPCC - Intergovernmental Panel on Climate Change. There is absolutely no room for doubt because there is a "scientific consensus." Anyone who questions the data or conclusion is an enemy of the state and humanity. https://www.youtube.com/watch?v=o7BGZnDkOVQ Richard Lindzen Pans Global Warming Hysteria at Schools https://www.youtube.com/watch?v=keDtanExdrc DR. LESLIE WOODCOCK A former NASA scientist has described global warming as "nonsense" saying that it is "absolutely stupid" to blame the recent UK floods on human activity. "It's absolutely stupid to blame floods on climate change, as I read the Prime Minister did recently. I don't blame the politicians in this case, however, I blame his so-called scientific advisors."
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