GPC Newsletter

March 2016

IN THIS ISSUE

APS TOPICAL GROUP ON THE PHYSICS OF CLIMATE

Message from the Editor

This is the fifth GPC Newsletter, timed as often the case with the APS March Meeting. We have now increased the frequency of the Newsletter to twice per year, and this is where you, the GPC membership, can be of enormous value. We invite comments, event notices, letters, and especially specific suggestions for content. Any of the above, addressed to GPCnews@aps.org, will be gratefully acknowledged in a timely fashion.

Welcome from the GPC Chair, *Juan Restrepo, Oregon State University*

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I am employed by a mathematics department, but I do have a license to practice physics. I work on the role played by oceans on climate. I also work on devising computational methods that yield forecasts and retrodictions using data and evolutionary models, taking into account their inherent uncertainties. There is little doubt in my mind that my background in physics has equipped me well with the skills I need to make inroads in climate science. It turns out that there are a significant number of very good scientists who work in climate science that also have a physics background.

The APS offers, through its members, an amazing array of talent and technical expertise, and a fresh perspective, with the potential of making impressive contributions to advancing the relatively young science of climate. The goal of the GPC is to become an effective topical group where these resources would be matched to scientific challenges associated with climate science. We are a young topical group and we depend heavily on its members for ideas, time, and effort to achieve this goal. I encourage you to suggest yourself and others to participate in making this cross-fertilization process happen. As a matter of fact, one of this year's executive committee meeting action items that I would like to have considered is to make the process of self-nomination to group officer positions easier. My intention is to make inroads on diversity and inclusion. Suggestions in this regard would be very much welcomed.

The topical group welcomes the whole gamut of technical approaches: computation, analysis/theory/modeling, experimentation, instrumentation, and so on. As a young topical group we have deliberately kept our focus, well, a bit unfocused. It is about Earth's climate and weather, it is about climate on other planets, and even magneto-hydrodynamics weather/climatology. In short, it is about multi-physics systems that are far from equilibrium.

Arguably, it is far more important to this organization to focus on creating a unique research venue. One with specific topics and approaches for research in important areas of climate research that other organizations might not emphasize, and/or for scientists whose approach simply does not fall within the purview of traditional geoscience research. We are keenly interested in hearing from you if you have suggestions on this matter, and I do hope you know that you are welcome to explore within our topical group how a solution to a physics problem might port to the climate science realm.

Obviously, the above addresses the pressing existential question of why APS is the home for this climate science activity and not some other professional society.

Climate science, I think, is fascinating and an important line of research—and, yes, for those who keep emphasizing this point unrelentingly, I reassure you that geoscientists fully agree with, and have known for a very long time, that it is complicated. But I would like to point out that when and if GPC develops a thriving unique research niche, it will also be special within APS, in the sense that it can enrich the organization in the following way: physicists know that to eke out fundamental facts about nature one would prefer to pose problems in a manner that yields the necessary control of the system to allow our tools to deliver sound

Welcome from the GPC Chair –

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explanations. However, this degree of isolation is not always practical or even useful: to wit, for example, biophysicists are pushing the limits, and contending with multi-physics and multi-scale dynamics. This is not a problem for them, it is a scientific challenge. A similar thing is happening at the interface of classical and quantum physics, obviously in geoscience, and in many industrial physics problems, among others.

GPC is a forum for science research in multi-physics, multi-scale problems, and for methodologies that could apply to multi-physics endeavors outside of climate. This why GPC is different in making itself extremely focused on inherently "outward looking" science. This past year we had three sessions at the November Division of Fluid Dynamics (DFD) in Boston. We will have several sessions at the upcoming March meeting (see elsewhere in this Newsletter). In May there will be a joint session at the Division of Atomic, Molecular and Optical Physics (DAMOP) meeting in Providence. We want to work with other APS divisions, forums, and groups interested in developing meetings, workshops, etc., that focus on multi-disciplinary science.

This year I chaired a superb Annual Meeting Program Committee: Morgan O'Neill (Weizmann), Daryl Holm (Imperial), Valerio Lucarini (Hamburg), Brad Marston (Brown). Our offerings for this year's March Meeting in Baltimore reflects some of what was said above: We will be offering a Focus Session on "Climate as a Non-Equilibrium and Stochastic System," as well as an Invited Session on "Clouds and Precipitation Physics." Both have that multi-physics/multi-scale flavor of scientific challenge. In the Focus session you might see more of the porting of physics ideas to climate, and in the second, talks on a theme with high-risk and high-reward: clouds & precipitation are extremely challenging aspects of climate dynamics. The themes will recur in years to come, in the hopes of making APS the place where the latest research in these topics is discussed and presented. The sessions are co-sponsored by DFD and GNSP, not only because many of our members attend their sessions, but also because we hope to have cross-fertilization in both directions. Our past GPC Chair, John Wettlaufer, will be giving a talk at the special session in honor of the friend and mentor of many of us in GPC, Leo Kadanoff.A number of climate scientists from outside of APS will be featured speakers and they are keenly interested in what GPC is doing about creating a venue for their work. They are being asked to stick around for the Climate Science Cafe, on March 15, 7:45 pm in the Ground Floor Lounge of the Rennaisance Baltimore Harborplace Hotel. I hope you will come, have a drink or some food, and use this opportunity to chat, one-on-one, with the speakers and the rest of the APS members.

Other things we are working on are: workshops at KITP and Banff on the focus and invited session themes. We are looking into partnering with other professional organizations, such as SIAM Geosciences, to produce tutorials and science exchanges. Some of us are supporting the creation of a new Oxford journal "Dynamics and Statistics of the Climate System" (full disclosure: Brad Marston (GPC chair elect) and I are members of the advisory board), a journal where GPC/APS themes and research will find a first rate, peer-reviewed, outlet for their research.

In closing, I want to thank the GPC Executive Committee for their guidance and hard work, and every past GPC chair: I consult with each of them and they provide invaluable guidance leading this organization. Finally, I want to acknowledge Peter Weichman who has been editing and producing this newsletter for a number of years. Why we don't have to plead for him to continue doing this and doing it so well is beyond me. Thanks, Peter.

I agree that climate is a complicated physical process. Rest assured, however, my salary will be the same whether the Earth warms up or not. I cannot answer questions regarding climate science implications, APS policy issues, or economic, as I am not qualified to do so. Likewise GPC stays away from these matters and focuses only on the science of climate.

I would be delighted to hear from you with your ideas and suggestions for making our group a better one, and/or about scientific breakthroughs that might be of interest to climate scientists both within and outside of APS.

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2016 APS March Meeting Events

GPC Climate Science Café

7:45 pm, Tuesday, March 15
Ground Floor Lounge of the Renaissance Baltimore Harbor Place Hotel

Meet the Climate Session speakers and colleagues over drinks and food. This is an informal social event in which shop talk is actually encouraged. Ask questions, propose climate science ideas, develop collaborations, become part of a growing group of physicists who are developing a research niche in several aspects critical to climate science, on Earth and on other planets.

GPC Executive Committee Members-at-Large and Newsletter Editor:

Left to right: Mary Silber (12/2018), Robert Ecke (12/2018), Mark Boslough (12/2017), Raymond Shaw (12/2017), Sharon Sessions (12/2016), Morgan O'Neill (12/2016), Peter Weichman (Newsletter Editor, 12/2016).

GPC Invited and Focus Sessions

This year we will have a **Focus Session on "Climate as a Non-Equilibrium and Stochastic System"** and an **Invited Session on "Clouds and Precipitation Physics."** Both of these are intended to be themes that we intend to revisit several times in the years to come, in the hopes of developing signature research themes for climate science within APS. The title of the first of these suggests that there are similarities between climate and other complex multi-physics systems and that this potential similarity may lead scientists to apply a host of techniques from dynamical systems and statistical physics in other contexts to make progress in understanding climate variability. The invited session on precipitation and cloud physics, on the other hand, is chosen because it represents a modeling "grand challenge" within climate and meteorology. Making inroads on precipitation modeling will have tremendous impact on climate and weather models. The impact might manifest itself in better predictions, nudictions, and retrodictions, and/or it might manifest itself in a better understanding of the hydrological cycle associated with climate/weather.

Both of these topics have common scientific challenges, namely, they deal with physics at spatio-temporal scales that are not clearly separated and thus amenable to traditional scientific methodologies. Secondly, they are both referring to very high dimensional problems. We have not lost hope, however, that there might be underlying low-dimensional structures and representations with which to understand and/or model climate variability and precipitation processes, respectively. Lastly, in the climate variability problem we are challenged by the fact that there is only one experiment to work with (our own Earth's singular history), and in the precipitation problem we are faced with unsolved challenges related to intermittency.

We have assembled a terrific array of contributed and invited talks on these two subjects. Our invited speakers have been instructed to take time during their talks to contextualize their work and to lead our audience to appreciate, in plain language, the challenges they face in their research. Please come to our Climate Science Cafe with your questions and comments for the speakers and fellow APS members. Climate science involves many scales and a lot of different physical processes. It stands to reason then, that it welcomes a variety of different points of view and expertise, namely, yours.

GPC Program Committee

Left to right: Juan Restrepo, (Chair), Darryl Holm, Valerio Lucarini, Brad Marston, Morgan O'Neill

The role of the Program Committee is to work with the Executive Officers in scheduling contributed papers within areas of interest to the GPC and in arranging symposia and sessions of invited papers sponsored by the GPC at Society meetings. From time to time the Program Committee may also organize special GPC meetings and workshops, some with and some without the participation of other organizations.

GPC Invited Session: Climate Science Frontier: Cloud and Precipitation Physics

(Session F12, 11:15 am – 2:15 pm, Tuesday, March 15)

ELISABETH MOYER
Associate Professor
Atmospheric Science
Department of Geophysical Sciences
University of Chicago

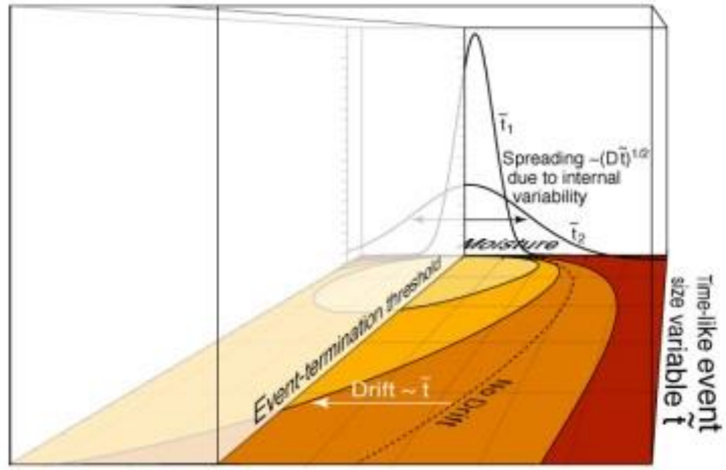
Title: Precipitation and atmospheric moisture transport responses to increased infrared opacity

Synopsis: The speaker's research interests fall in two main threads. The first includes the use of the isotopic composition of atmospheric water vapor as a tracer of convective processes, cirrus formation, and stratosphere-troposphere exchange; and the design of spectroscopic techniques for *in situ* trace gas measurements. The second includes climate (and human) response to greenhouse gas forcing; development of tools for impacts assessment; statistical emulation of climate model output; and climate and energy policy evaluation.

Climate models robustly project increases in global precipitation as global temperatures rise under higher CO_2 concentrations: a warmer world is one with a more vigorous hydrological cycle. In this the simple physics that underlies many seemingly complex changes in precipitation will be reviewed. Climate models generally project increases in mean precipitation (rain rate across all time) of some ~3%/K, lower than the rise in precipitation intensity (rain rate during a precipitating event), which increases at ~6-7%/K, following the rise in atmospheric water vapor. (Atmospheric water content itself simply follows the temperature-dependent vapor pressure of water.) Mean precipitation increases are generally assumed to be radiative in origin, driven by the increased atmospheric infrared opacity. It will be shown that they can be seen as responses to surface energy budget constraints, with physics sufficiently straightforward that they can be reproduced in simple one-column models. One-column experiments further suggest that the primary radiative driver of precipitation increases is infrared absorption by increased atmospheric water vapor (whose concentration falls off steeply with altitude). The infrared properties of CO_2 (which is well-mixed) instigate warming but play very little role in the Earth's hydrological response. Results will also be shown suggesting possible responses of precipitating systems that allow the discrepant changes in mean precipitation and precipitation. In high-resolution model simulations, the primary compensating factor is a reduction in the size of precipitating events: future storms become smaller.

J. DAVID NEELIN
Professor of Atmospheric and Oceanic Sciences
UCLA

Title: Prototypes for the dynamics underlying precipitation and temperature extremes



Synopsis: Projecting changes in precipitation and temperature extreme events can be aided by a deeper understanding of the dynamics underlying such variations. For precipitation, this is closely connected to the interaction of fast, small-scale motions with variability of large-scale climate. Simple prototype models derived from climate-model equations can aid understanding of underlying dynamics, point to analysis methods, illuminate connections among related quantities, and lead to hypotheses for the dynamics.

Examples include first-passage prototypes for precipitation events, illustrated in the figure, as a way to understand a set of connected observational analyses for statistics of precipitation dependence on temperature and water vapor. In the case illustrated, competing factors underlying precipitation event termination are schematized with scaling solutions for the Fokker-Planck equation as a function of moisture above a threshold at which precipitation ceases. Moisture convergence variations as represented by stochastic forcing drive the spread of probability that yields a scale-free accumulation regime. The water loss associated precipitation drives a drift term that yields a different regime governing probabilities of events larger than a given scale. The art is in choosing and adapting these prototypes suitably to match analysis from complex climate models and observations.

This approach yield insights into the form of present-day observed distributions and predictions for the form of the global warming change to evaluate in climate models. In distributions of water vapor and temperature, the widespread occurrence of non-Gaussian tails is likely explained in part by prototypes for tracer advection across a maintained gradient. The shape of these tails can have substantial implications for regional changes in probabilities of precipitation and temperature extremes with large-scale warming.

This is an area where physics students looking to apply their background to messy but fascinating real world climate problems in graduate school or postdoctoral work have excellent opportunities.

DAVID ROMPS
Assistant Professor
Earth & Planetary Science
U.C. Berkeley

Title: The physics of atmospheric instability, lightning, and global warming

Synopsis: With a long list of unsolved problems – many of them directly relevant to our daily experience – Earth's atmosphere is a rich playground for physicists. This richness stems from the presence of water, which interacts with radiation and thermodynamics in ways that fundamentally alter the nature of the atmosphere. As a consequence, there are many basic questions about the atmosphere that remain unsolved, such as: what sets the speed of updrafts in storms? Although this question remains unanswered, progress has recently been made on many related topics. In this talk, I will give an overview of the progress from the last two years on the development of theories for relative humidity, convective instability, lightning, severe weather, and their responses to global warming.

OLIVIER PAULUIS
Professor in Atmosphere Ocean Science
Courant Institute of Mathematical Sciences
New York University

Title: Thermodynamic analysis of atmospheric convection

Bibliography:

Isentropic analysis applied to convection, hurricanes and Walker circulation, O. Pauluis, A. Mrowiec, J. Slawinska, and F. Zhang, Proc. NE Tropical Conference, May 27, 2013.

Isentropic Analysis of Convective Motions, O. M. Pauluis, A. A. Mrowiec**,** *J. Atmos. Sci.* **70**, 3673-3688 (2013).

Radiation impacts on conditionally unstable moist convection, O. Pauluis and J. Schumacher, J. Atmos. Sci. **70**, 1187-1203 (2013).

A theory for the lower-tropospheric structure of the moist isentropic circulation, F. Laliberte, T. A. Shaw, and O. Pauluis, J. Atmos. Sci. **69**, 875-890 (2012).

Midlatitude Tropopause and Low-Level Moisture, Y. Wu, O. Pauluis**,** *J. Atmos. Sci.* **71**, 1187-1200 (2014).

Examination of Isentropic Circulation Response to A Doubling of Carbon Dioxide Using Statistical Transformed Eulerian Mean, Y. Wu and O. Pauluis, *J. Atmos. Sci.* **70**, 1649-1667 (2013) .

Satellite estimates of precipitation-induced dissipation in the atmosphere, O. Pauluis and J. Dias, *Science* **24**, 953-956 (2012).

Thermodynamic consistency of a pseudo-incompressible approximation for General Equations of state, R. Klein, and O. Pauluis, J. Atmos. Sci. **69**, 961-968 (2012).

Moist recirculation and water vapor transport on dry isentropes, F. Laliberte, T. A. Shaw, and O. Pauluis, J. Atmos. Sci. **69**, 875-890 (2012).

Analysis of cloud-resolving simulations of a tropical mesoscale convective system observed during TWP-ICE: Vertical fluxes and draft properties in convective and stratiform region, A. Mrowiec, C. Rio, A. M. Fridlind, A. S. Ackerman, A. D. Del Denio, O. M. Pauluis, A. C. Varble, and J. W. Fan, JGR-Atmos. **117** (2012).

Tropical and subtropical meridional latent heat transport by disturbances to the zonal mean and its role in the general circulation, T. Shaw and O. Pauluis, J. Atmos. Sci. **69**, 1872-1889 (2012).

Cloud patterns and mixing properties in shallow moist Rayleigh-Benard convection, T. Weidauer, O. Pauluis and J. Schumacher, New J. Phys. **14** (2012).

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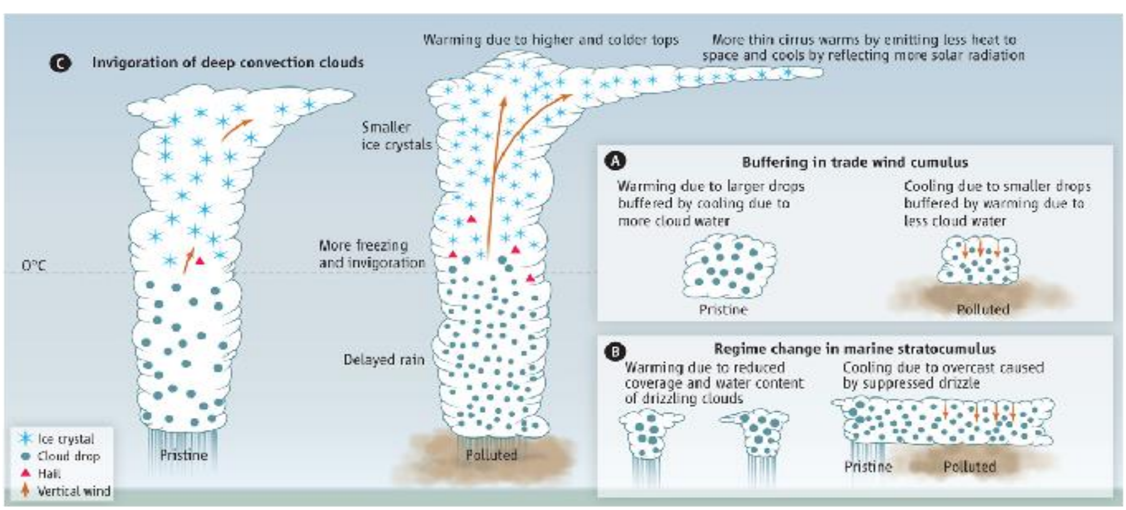
LEO DONNER
Physical Scientist
Geophysical Fluid Dynamics Laboratory/NOAA

Title: Aerosols, Clouds, and Precipitation as Scale Interactions in the Climate System and Controls on Climate Change

Synopsis: Clouds are major regulators of atmospheric energy flows. Their character depends on atmospheric composition, dynamics, and thermodynamic state. Clouds can assume organized structures whose scales are planetary, while processes important for determining basic properties occur on the scale of microns. The range of processes, scales, and interactions among them has precluded the development of concise theories for the role of clouds in climate, and limitations in modeling clouds in complex climate models remain among the key uncertainties in understanding and projecting climate change.

This talk will explore the connections between the dynamics of clouds, as represented by their upward velocities, and the processes regulating the formation, growth, and precipitation of cloud droplets and ice crystals. These updraft properties are important controls on how changes in atmospheric aerosols from both natural and human sources alter energy flows by clouds and, subsequently, lead to climate change. The talk will also examine relationships suggested by climate models between cloud dynamics, especially small-scale mixing between clouds and surrounding air (entrainment), and the



By nucleating a large number of smaller cloud drops, aerosols affect cloud radiative forcing in various ways. [Rosenfeld *et al.*, Science 343, 379–380 (2014)]

sensitivity of climate to changes in the Earth's energy balance produced by greenhouse gases and aerosols. The prospect that constraints posed by observations of cloud dynamics could reduce uncertainty in understanding the role of clouds in climate change will be considered. In somewhat more detail, the distribution function of vertical velocities (updraft speeds) in clouds is an important control on climate forcing by clouds and possibly a strong correlate with climate sensitivity. (Climate forcing refers to the change in Earth's energy balance as atmospheric composition changes, in particular, due to human activity. Climate sensitivity is defined here as the equilibrium change in globally averaged annual surface temperature as a result of doubled carbon dioxide.) Vertical velocities are central because they determine the thermodynamic environment governing phase changes of water, with both equilibrium and non-equilibrium phenomena important. The spatial and temporal spectra of relevant vertical velocities include scales both numerically resolved by climate models and below their resolution limit. The latter implies a requirement to parameterize these smaller scale motions in models. The scale dependence of vertical velocities and emerging observational constraints on their distribution provide new opportunities for representing aerosols, clouds, and precipitation in climate models. Success in doing so could provide important breakthroughs in understanding both climate forcing and sensitivity

GPC Focus Session: Climate as a Non-equilibrium and Stochastic System

(Session H51, 2:30 pm – 5:30 pm, Tuesday, March 15)

Invited talks:

VALERIO LUCARINI
Professor
Center for Earth System Research and Sustainability
Meteorological Institute
University of Hamburg

Title: **Fluctuations and Response in Geophysical Fluid Dynamics**

Synopsis: The climate is a complex, chaotic, non-equilibrium system featuring a limited horizon of predictability, variability on a vast range of temporal and spatial scales, instabilities resulting into energy transformations, and mixing and dissipative processes resulting into entropy production. Despite great progresses, we still do not have a complete theory of climate dynamics able to account for instabilities, equilibration processes, response to changing parameters of the system, and multiscale effects. We will outline some possible applications of the response theory developed by Ruelle for non-equilibrium statistical mechanical systems, showing how it allows for setting on firm ground and on a coherent framework concepts like climate sensitivity, climate response, and climate tipping points, and to construct parametrizations for unresolved processes. We will show results for comprehensive global climate models. The results are promising in terms of suggesting new ways for approaching the problem of climate change prediction and for using more efficiently the enormous amounts of data produced by modeling groups around the world.

Reference: V. Lucarini, R. Blender, C. Herbert, F. Ragone, S. Pascale, J. Wouters, "Mathematical and Physical Ideas for Climate Science," Reviews of Geophysics **52**, 809-859 (2014).

HUSSEIN ALUIE
Assistant Professor
Department of Mechanical Engineering
University of Rochester
The Johns Hopkins University

Title: **A Novel Method to Unravelling Energy Pathways in the Ocean**

Synopsis: Large-scale currents and eddies pervade the ocean and play a prime role in the general circulation and climate. The coupling between scales ranging from O(10^4) km down to O(1) mm presents a major difficulty in understanding, modeling, and predicting oceanic circulation and mixing, where the energy budget is uncertain within a factor possibly as large as ten. Identifying the energy sources and sinks at various scales can reduce such uncertainty and yield insight into new parameterizations. To this end, we refine a novel coarse-graining framework, which accounts for the spherical geometry of the problem, to directly analyze the coupling between scales. We apply these tools to strongly eddying high-resolution simulations using LANL's Parallel Ocean Program (POP).

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Contributed talks:

Sharon Sessions, Stipo Sentic, Zeljka Fuchs, David Raymond	Balanced Dynamics in the Madden-Julian Oscillation
Ivan Sudakov	Stochastic dynamics of melt ponds and sea ice-albedo climate feedback
Morgan E. O'Neill, Diamilet Perez-Betancourt, Allison A. Wing	The impact of the diurnal insolation cycle on the tropical cyclone heat engine
Brad Marston , Baylor Fox-Kemper , Joe Skitka	Towards a General Turbulence Model for Planetary Boundary Layers Based on Direct Statistical Simulation
John Wettlaufer , Srikanth Toppaladoddi	Non-equilibrium Statistical Mechanics and the Sea Ice Thickness Distribution
Thijs Heus , Axel Seifert , Robert Pincus , Bjorn Stevens	Large-eddy simulation of the transient and near-equilibrium behavior of precipitating shallow
Navid Constantinou , Brian Farrell , Petros Ioannou	Statistical state dynamics of jet/wave coexistence in beta-plane turbulence
Mirjana Sakradzija , Axel Seifert , Thijs Heus , Anurag Dipankar	A stochastic shallow cumulus ensemble model as a scale-aware parameterization of convective fluctuations

GPC Nominating Committee

Left to right: Robert Behringer (Chair),Robert de Zafra, Dan Rothman, Sharon Sessions, Surjalal Sharma

The role of the Nominating Committee is to prepare a slate of candidates for the open elected positions each year. The Nominating Committee shall also respond with appropriate names to the Society's call for nomination for senior Society positions.

GPC Communications Committee

Left to right: Peter Weichman (Chair), Barbara Levi

The role of the Communications Committee is to have oversight of the Newsletter and any other publications that may be established by the GPC. The Communications Committee shall also be responsible for keeping the physics community and other interested communities informed about climate physics issues, activities, and accomplishments through the Newsletter, GPC website and email messages.

Upcoming Events and Other Links of Interest

APS Climate Change Statement Review, including links to a number of relevant documents.
See also the perhaps unusually colorful January 2015 POPA report:
Report from the FPS Representative on the Panel on Public Affairs of the APS, which provides links to some interesting public discussion, including:
Climate Science Is Not Settled, September 19, 2014 Wall Street Journal editorial by Steven Koonin (then APS Climate Statement Review Subcommittee Chair), and forceful rebuttal:
Climate Science Is Settled Enough, October 1, 2014 Slate.com article by Raymond Pierrehumbert.

The National Research Council reports on Climate Intervention (more popularly known as climate engineering) were recently released, in two parts: Carbon Dioxide Removal and Reliable Sequestration and Reflecting Sunlight to Cool Earth.

Abstract: *Climate intervention is no substitute for reductions in carbon dioxide emissions and adaptation efforts aimed at reducing the negative consequences of climate change. However, as our planet enters a period of changing climate never before experienced in recorded human history, interest is growing in the potential for deliberate intervention in the climate system to counter climate change. This study assesses the potential impacts, benefits, and costs of two different proposed classes of climate intervention: (1) carbon dioxide removal and (2) albedo modification (reflecting sunlight). Carbon dioxide removal strategies address a key driver of climate change, but research is needed to fully assess if any of these technologies could be appropriate for large-scale deployment. Albedo modification strategies could rapidly cool the planet's surface but pose environmental and other risks that are not well understood and therefore should not be deployed at climate-altering scales; more research is needed to determine if albedo modification approaches could be viable in the future.*

Raymond Pierrehumbert is one of the report authors, and has posted a more personal view in the form of a February 10, 2015 Slate.com article: Climate Hacking is Barking Mad.

The American Geophysical Union (AGU) conference list, especially the Fall Meeting, San Francisco, CA, December 12-16, 2016.

The American Meteorological Society (AMS) conference list.

47th Annual Meeting of the APS Division of Atomic Molecular and Optical Physics (DAMOP), Providence, RI, May 23-27, 2016,

69th Annual Meeting of the APS Division of Fluid Dynamics (DFD), Boston, MA, November 22-24, 2016

Spring 2016 Meeting of the New England Section of the American Physical Society, Wheaton College, Norton, MA, April 1-2, 2016. The theme of the meeting is Fluid Dynamics of Very Large and Very Small Systems. The physical behaviors encountered, and the scientific puzzles to be addressed, vary dramatically with the size of the system under consideration: in this meeting, a variety of extreme cases will be considered.