1st Pan-GASS Meeting: Observing, Modeling, and Representing Atmospheric Processes

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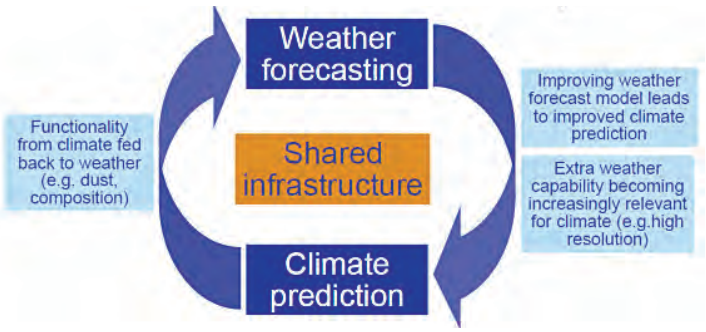
Building upon the tradition and success of past GEWEX Cloud System Study (GCSS) pan-meetings, the 1st Pan-Global Atmospheric System Studies (GASS) Meeting was held, bringing together over 200 scientists involved in GASS activities to review advances in observing, modeling, and parameterizing atmospheric processes. In addition, joint sessions were held with the GEWEX Global Land/Atmosphere System Studies (GLASS) Panel to facilitate collaboration.

From increasing the lead time for the prediction of severe weather events to reducing the uncertainty of future projections of centennial climate change, the need for a better representation of the atmosphere in models remains essential. The GASS community uses observations, process studies, and model experiments to support the improvement of atmospheric models. GASS organizes projects (typically involving the comparison of several models with detailed observations) to bring together scientists involved in all aspects of atmospheric systems or processes. Current and proposed GASS activities discussed at the meeting include:

- Improving the representation of stable boundary layers
- Diagnosing cloud and radiation processes in models to address systematic biases
- Studying convective systems through the weak temperature gradient method
- Evaluating model processes when they are partially resolved (the grey-zone)
- Cloud and precipitation microphysics modeling in a dynamically constrained environment
- Marine boundary layer cloud feedbacks in a warming climate
- Radiative processes in observations and models
- Observing and modeling cirrus clouds
- Modeling tropical convection observed during the Cooperative Indian Ocean Experiment on Intraseasonal Variability (CINDY)/Dynamics of the Madden-Jullian Oscillation (DYNAMO)
- Observing and modeling polar clouds with the Indirect and Semi-Direct Aerosol Campaign (ISDAC)
- Stratocumulus-to-trade cumulus transition
- Vertical structure and diabatic heating of the Madden-Julian Oscillation (MJO)
- Improving land-atmosphere interactions (a joint GASS/GLASS activity)
- Assessing coupling diagnostics using observations at the Atmospheric Radiation Measurement (ARM) Program Southern Great Plains (SGP) site (a GLASS project)

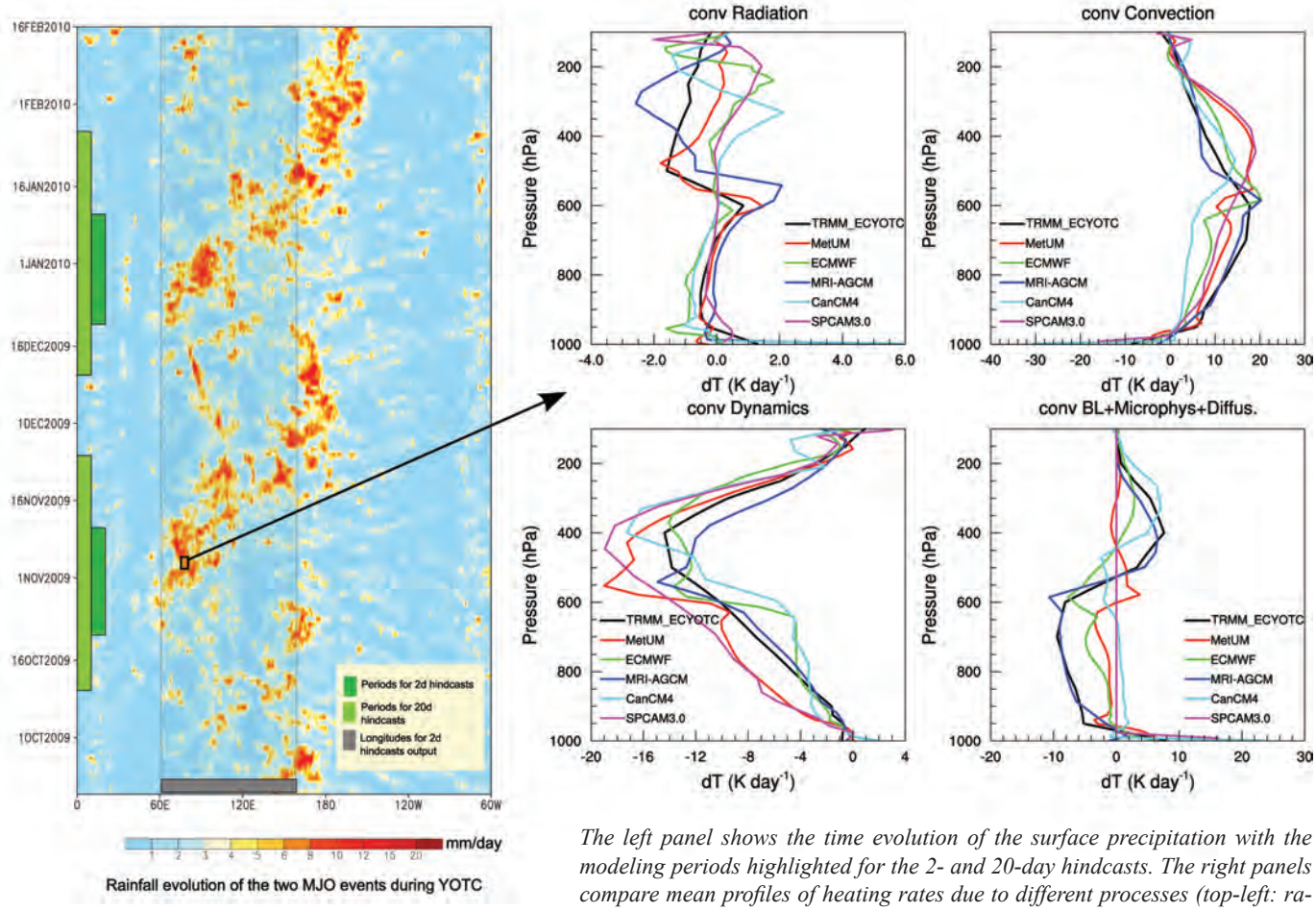


Benefits of the seamless modeling strategy. Courtesy of Julia Slingo, Met Office, UK.

Future needs for observations to support model development were addressed and the discussion was complemented by a presentation on the novel use of CloudSat and A-Train satellite observations for model diagnosis of cloud microphysical processes by Kentaroh Suzuki. Satellites, such as the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) satellite and CloudSat, now provide the critical data necessary for the evaluation of atmospheric processes; however, the future of these type of observations is uncertain beyond the Earth Clouds Aerosols and Radiation Explorer (EarthCARE) satellite mission. The importance of field campaigns in making in situ and long-term measurements at supersites like the ARM SGP site were identified as vital to the process of improving models used for weather and climate prediction. The ongoing need for observations as simple as condensate profiles and their spatial distributions was highlighted, as well as the need for associated vertical velocity processes. A report is being prepared to inform the World Climate Research Programme (WCRP) of the needs of the model development community.

Plenary sessions covered many general areas related to atmospheric processes, observations, and modeling. The importance of a seamless approach to weather and climate prediction was noted in several of the talks given, and is fundamental to many of the GASS projects. In particular, Julia Slingo, Met Office, presented the benefits of using seamless and multiscale ap-

MJO Model Comparison



The left panel shows the time evolution of the surface precipitation with the modeling periods highlighted for the 2- and 20-day hindcasts. The right panels compare mean profiles of heating rates due to different processes (top-left: radiation; top-right: convection; bottom-left: dynamics; and bottom right: microphysics and boundary layer) from the initial six models submitted to the 2-day hindcast case study. The period and region of average is shown in the blue box.

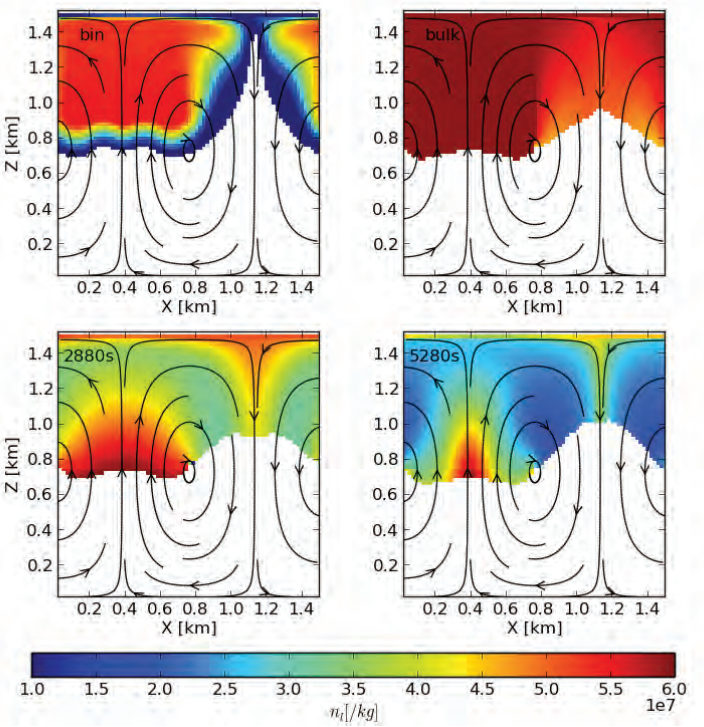
proaches in weather and climate prediction, and how weather prediction models benefit from being tested in climate simulations and vice versa (see the figure on page 10).

A new goal for GASS and a focus of the Pan-GASS Meeting is to entrain more experts in radiative transfer in the GASS community. Many of the presentations by GASS projects highlighted the importance of radiative transfer forcing in the simulation of atmospheric processes. Bill Collins, Lawrence Berkeley National Laboratory, presented the current state of radiative transfer parameterizations in the "best" climate models. His talk showed that in plain parallel situations, with the correct inputs, the errors in radiative transfer are small. However, there remain significant challenges around constraining the key inputs, such as the horizontal and vertical heterogeneity of the atmosphere. He also demonstrated that spectral sampling can be used as a tool in the early detection of anthropogenic climate change. Lazaros Oreopoulos, National Aeronautics and Space Administration Goddard Space Flight Center, gave a presentation on the Continuous Intercomparison of Radiation Codes (CIRC), which is now a joint GASS-GEWEX Data and Assessments Panel (GDAP) activity. This led to useful discussions on how a CIRC component could complement several GASS projects.

Another area of interest for GASS is large-scale tropical moist convection. GASS and the WCRP-World Weather Research Programme (WWRP) MJO Task Force are involved in a joint project to study the diabatic heating and moistening profiles associated with the MJO. This collaborative project (see initial results in the figure above) was reinforced by the strong presence of both communities at the meeting. On a closely related topic, Adam Sobel, Columbia University, presented the weak-temperature gradient methodology to evaluate and develop parameterizations. This methodology showed great promise in isolating the behavior of atmospheric parameterizations in a tropical environment, and a new GASS project based upon these ideas is planned.

There were many talks about the influence of aerosols on clouds and their subsequent impact on radiative forcing of the atmosphere. Graham Feingold, National Center for Atmospheric Research, noted that while aerosols can influence clouds and their production of precipitation, the whole cloud system should be considered, including cloud-scale dynamics. This is necessary to really understand the impacts of the indirect effects of aerosols on the climate system. Without considering the "buffering" role of cloud dynamics the role of aerosols may be poorly estimated. The figure below shows initial results from a GASS project to use a framework to evaluate warm microphysics and aerosol processing in isolation from large-scale dynamics.

The 1st Pan-GASS Meeting was very productive and brought together atmosphere and land model developers, the observational and evaluation community, process modelers, and experts in tropical dynamics. GASS has over ten ongoing projects with several new areas of collaboration suggested at the meeting. The plenary presentations can be found at: *http://www.gewex.org/2012gass_conf.html*. Information about GASS projects and how to participate in them can be found at: *http://www.gewex.org/gass_panel.html* and new projects will be advertised through the GASS mailing list at: *http://lists.gewex.org/mailman/listinfo/gass*).



Kinematic tests of warm microphysics and aerosol processing, courtesy of Ben Shipway. Arrows show the direction of prescribed flow with colors representing cloud droplet number concentrations. The top panels show equilibrium values comparing a bin model with a bulk model with fixed aerosol. Bottom panels show snapshots at later times when the bulk model continues to run with the nucleation scavenging processes turned on, ultimately resulting in decreased droplet concentrations.