

GASS Panel Reports for the 31th GEWEX SSG Meeting 2019

Full Panel Name (Acronym) : Global Atmospheric System Studies Panel (GASS)
Reporting Period : 01 January - 31 December 2018
Starting Date : 2018
End Date (where appropriate) : NA
URL : www.gewex.org/panels/global-atmospheric-system-studies-panel

Membership

Chair(s) and Term Dates : Xubin Zeng, 2017 - Present
Daniel Klocke, 2017 - Present
Members and Term Dates : Irina Sandu, 2018 - Present
Ian Boutle, 2018 - Present
Shaocheng Xie, 2018 - Present
Yongkang Xue, 2018 - Present

Panel Objectives, Goals and Accomplishments during Reporting Period

Overall Panel Objective(s)

- The Global Atmospheric System Studies (GASS) Panel facilitates and supports the international community that carries out and uses observations, process studies, and numerical model experiments with the goal of developing and improving the representation of the atmosphere in weather and climate models. Primarily, GASS coordinates scientific projects that bring together experts to contribute to the development of atmospheric models.

List of Panel Goals

Adjust yearly

- Initiate at least two new projects
- Expand the panel by adding at least four new panel members
- Increase cooperation with other international programs (particularly WGNE and WWRP) by attending both WGNE and WWRP steering group meetings and establishing 1 or 2 direct links (i.e. GASS representatives on WGNE and WWRP)

List of Key Results

Adjust yearly with respect to goals

- Four new projects initiated, another is close to being launched (see below)
- Panel members recruited, based on projects (see Panel Membership above). Panel needs to develop further.
- Enhanced communication with WGNE and WWRP: Discussion of Klocke and Zeng with WWRP leaders during the GEWEX Open Science Meeting in May 2018; direct engagement of WGNE and WWRP in developing GASS projects; Klocke attended the WWRP SSG meeting and gave a GASS update in November 2018; GASS Panel member Irina Sandu has a joint membership in GASS and WWRP Polar Program Committee; Klocke gave a GASS update to the WGNE SSG meeting via video conference in October 2018.

Other Science Highlights

Not part of the 2-3 major accomplishments

- Highly successful Pan-GASS Conference in Australia from 26 February – 2 March 2018, with a report in GEWEX News (Zeng and Klocke 2018) and a BAMS Article (Zeng et al. 2018) to highlight the challenges and opportunities in global atmospheric system studies.

- Close collaboration with the DOE ARM (Atmospheric Radiation Measurement) and ASR (Atmospheric System Research) Programs: ARM Technical Director Jim Mather attended, and gave an oral presentation on, the Pan-Gass Conference in February 2018; Zeng gave an invited talk on the GASS-ARM/ASR partnership at the ASR/ARM PI's meeting in March 2018; ARM observations will be used in GASS projects; ARM/ASR provides small support for GASS-related meetings, and ARM is willing to host GASS data.
- Streamlining the GASS relationship with PROES (GAP, UTCC): GEWEX Upper Tropospheric Clouds and Convection Process Evaluation Study (UTCC PROES), building a bridge between GDAP and GASS, will now also be part of GASS; the possibility of a link to the WCRP SPARC (Stratosphere-troposphere Processes And their Role in Climate) Project was discussed at the last UTCC PROES meeting; UTCC provides a link of GEWEX to the WCRP SPARC (Stratosphere-troposphere Processes And their Role in Climate) Project; Zeng gave an invited talk on GASS-ACPC/GAP relation at the ACPC Conference in April 2018; GAP (GEWEX Aerosol Precipitation) Project as a PROES is now covered by GASS; GAP is closely related to the joint iLEAPS/GEWEX ACPC (Aerosols, Clouds, Precipitation and Climate) Initiative.
- Pursuit of collaboration with the WCRP CFMIP (Cloud Feedback Model Intercomparison Project): Zeng gave an invited talk on GASS at the CFMIP Conference in October 2018, followed by the conversation between leaders of GASS and CFMIP on future joint projects.

Panel Activities during Reporting Period

List of Panel Activities and Main Result

- Four new projects initiated, another is close to being launched (see next)
- Four new GASS Panel members appointed (see Panel Membership above)
- Collaborations with WGNE, WWRP, GEWEX/GLASS in developing GASS projects (see next)
- Streamlined relationship of GASS with PROES (GAP, UTCC) (see above)
- Formalized partnership with DOE ARM/ASR (see above)
- Pursuit of collaboration with WCRP CFMIP (see above)
- UTCC PROES: This activity, together with a working group, was established in 2015 to advance our understanding on climate feedback of upper tropospheric clouds. Since then the activities were yearly reported to the GDAP Panel. Highlights in 2018: construction of a website by the French Data Center AERIS (<https://gewex-utcc-proes.aeris-data.fr/>), the 4th UTCC PROES workshop in October 2018, hosted by Sorbonne University in Paris (presentations available at the website and summary in GEWEX News Feb 2019).
- We have comprehensively revised the GASS projects web site, dividing projects into Current Projects, New Projects to be launched, and Finished Projects. The Finished Projects are listed here, and no updates are provided:
 - Microphysics
 - Boundary Layer Cloud
 - Polar Cloud
 - Cirrus Model Intercomparison
 - Clouds Above the United States and Errors at the Surface (CAUSES)
 - CFMIP-GASS Intercomparison of LES and SCMs (CGILS)
 - GEWEX Atmospheric Boundary Layer Study 3 (GABLS-3)
 - Grey Zone Project: Cold Air Outbreak Intercomparison Case
 - Vertical Structure and Diabatic Processes of the Madden-Julian Oscillation: A joint project with the MJO Task Force using YOTC data

List of New Projects and Activities in Place and Main Objective(s)

- Surface Drag and Momentum Transport project, Objective: bringing together the observational and modelling communities for efforts to constrain and thereby improve the representation of drag processes (such as orographic drag, convection momentum transport etc), Leads: Irina Sandu, Louise Nuijens, Annelize van Niekerk. The first phase in this project, called COORDE (COncstraining ORographic Drag Effects), was launched in September 2018 and the analysis of the first submitted results is currently under way. This activity aims at understanding the impact of resolved and parametrized orographic drag on the atmospheric circulation through the COORDEnation of model experiments and output from several modeling centres. The protocol of the COORDE inter-comparison project follows the study of Van Niekerk et al. (2018). COORDE is led by Annelize van Niekerk and Irina Sandu. The idea is to use high and low resolution simulations over some of the most complex mountain chains to identify caveats of blocking and gravity wave drag parametrizations. This is an excellent partnership between WGNE and GASS: WGNE did the initial surface drag project, while we take the next step as a GASS/WGNE joint project to focus on understanding orographic drag processes and their representation in models. An article will be published in the next issue of GEWEX News. The second phase will focus on convective momentum transport and will likely be related with the upcoming EUREC4A field campaign (Jan/Feb 2020) and the modelling activities around it. This should start in 2020.
- Impact of Initialized Land Temperature and Snowpack on Sub-Seasonal to Seasonal Prediction (LS4P), Objective: quantify impact of surface and subsurface initialization on sub-seasonal to seasonal predictions and assess the relative role in comparison to sea-surface temperature, Leads: Yongkang Xue, Tandong Yao, Aaron Boone. Close interaction with WWRP and WGNE: Discussion of Klocke and Zeng with WWRP and WGNE (??) leaders during the GEWEX Open Science Meeting in May 2018; sent the initial White Paper to WGNE and WWRP; further interaction with WWRP/WCRP S2S (Sub-seasonal to Seasonal) Prediction Project and other relevant projects; this led to the revision of the final project white paper. This also has a close collaboration with GEWEX GLASS and the GEWEX GHP, particularly the Third Pole Environment (TPE) program.
- Demistify: An LES and NWP Fog Modeling Intercomparison, Objective: Identify the ability of models to simulate radiation fog and identify key processes, Leads: Ian Boutle. This project is closely related to NWP in WWRP.
- Improving the Simulation of Diurnal and Sub-Diurnal Precipitation over Different Climate Regimes, Objective: understand and improve the diurnal cycle in atmospheric models in different climate regimes, Leads: Shaocheng Xie, David Neelin, Peter Bechtold, Hsi-Yen Ma. This project will make use of a hierarchy of models including SCMs/CRMs/LESs, Cloud Permitting Models, and GCMs to diagnose and investigate the associated processes and model biases in depth by comparing with observational data from DOE ARM and other sources. It is relevant to weather and climate process understanding and model improvements. <http://portal.nersc.gov/project/capt/diurnal/>
- GEWEX Upper Tropospheric Clouds and Convection Process Evaluation Study (UTCC PROES) – now part of GASS; Objective: to gain a better understanding of the interconnection between the convection and the properties of the outflowing anvils; Lead: Claudia Stubenrauch.
- GEWEX Aerosol Precipitation (GAP) Project as a PROES – now covered by GASS; Objective: to enhance our understanding of aerosol-precipitation interactions on a regional to global scale; Leads: Sue van den Heever and Philip Stier.

List of New Projects and Activities Being Planned, including Main Objective(s) and Timeline, Lead(s)

- Second Phase of the “Grey Zone” Project Based on the EUREC4A and Phase III of the GATE Field Campaigns WGNE/GASS White Paper on Scale-Awareness, Stochasticity, and Convective Organization, Objective: It is designed to have two parts: 1) focusing on shallow convection, and 2) exploring deep convection, Leads: Lorenzo Tomassin, Rachel Honnert, George Efstathiouk, Adrian Lock, Pier Siebesma. This project represents another excellent partnership between WGNE and GASS: The first phase was already a joint WGNE/GASS activity, while we take the next step as a GASS/WGNE joint project. This is also related to the WCRP CFMIP project. This

project has gone through iterations with international programs (WGNE, WWRP) and the GASS community, and it will be launched in early 2019.

- Physics-dynamics coupling; Objective: to improve the understanding and numerical treatment of physics-dynamics coupling in atmospheric models; Leads: Hui Wan and Ben Shipway. White paper has been prepared; we plan to launch it in second half of 2019.
- There are early discussions about a follow up on the GABLS projects. Details will be provided next time.
- Joint effort on the surface flux project of WGNE along with other programs; more details will be provided next time.

Science Issues and Collaboration during Reporting Period

Contributions to Developing GEWEX Science and the GEWEX Imperatives.

a. Data Sets

- all data relevant to GASS projects (forcing data, model output, and validation data) will be available to the community; DOE ARM is willing to host GASS data

b. Analysis

- GASS projects are expected to develop new analysis tools and softwares that will be available to the community

c. Processes

- GASS projects are about process understanding and model treatment (e.g., precipitation, clouds, surface fluxes, coupling surface to atmosphere, aerosols, dynamics-physics coupling)

d. Modeling

- GASS projects aim to improve different aspects of atmospheric models and related processes

e. Application

- GASS projects intends to improve both weather and climate models

f. Technology Transfer

- GASS projects intends to transfer improved model treatments to weather and climate centers

g. Capacity Building

- GASS email list includes 500+ people (from graduate students to senior scientists in developed and developing countries); all GASS project white papers are circulated on this email list; junior scientists and scientists with limited resources are also encouraged to participate in GASS projects.

List contributions to the GEWEX Science Questions and plans to include these.

a. Observations and Predictions of Precipitation

- Three existing GASS projects directly address precipitation: the precipitation diurnal cycle, land impact on S2S prediction, and GAP
- Two projects to be launched in 2019 will also address precipitation: the gray zone project and the physics-dynamics coupling project.

b. Global Water Resource Systems

- One GASS project (land impact on S2S prediction) is directly related to the global water resources systems

c. Changes in Extremes

- All GASS projects aim to improve weather and climate models, including their capability in studying weather and climate extremes

d. Water and Energy Cycles

- All GASS projects aim to improve weather and climate models, including their capability in studying the water and energy cycles

Other Key Science Questions

List 1 – 3 suggestion that you anticipate your community would want to tackle in the next 5-10 years within the context of a land-atmosphere project

- How can we quantify the local and remote impacts of land-atmosphere interaction versus remote impacts of ocean-atmosphere interaction on weather and climate over land (e.g., water for the food baskets, extremes)?
- How do dynamics and physics interact in earth system models?

Contributions to WCRP including Current Grand Challenges

Briefly list any specific areas of your panel's activities in particular to the grand challenges "Extremes" and "Water for the Food Baskets" which is not covered under 2.

- Weather and climate extremes: All GASS projects aim to improve weather and climate models, enabling the modeling study of weather and climate extremes
- Water for the food baskets: Several current and planned GASS projects (precipitation diurnal cycle, land impact on S2S prediction, GAP, gray zone, and physics-dynamics coupling) address precipitation that is directly related to water for the food basket
- Clouds, circulation and climate sensitivity: UTCC PROES, the gray zone project and the physics-dynamics coupling project (to be launched by GASS in 2019) are directly relevant to the study of clouds, circulation and climate sensitivity
- Near-term climate prediction: the GASS project on the land impact on S2S prediction is directly relevant to near-term climate prediction; the GASS COORDE project is also very relevant for prediction on all time scales.

Cooperation with other WCRP Projects, Outside Bodies and links to applications

e.g. CLIVAR, CliC, SPARC, Future Earth, etc.

- WWRP/WCRP S2S (Sub-seasonal to Seasonal) Prediction Project: the GASS project on the land impact on S2S prediction cooperated with the WWRP/WCRP S2S Prediction Project in the development of the white paper and implementation
- WCRP/WMO-CAS WGNE: Two GASS projects are joint with WGNE, and additional GASS projects are also related to WGNE
- WWRP: We have involved WWRP in the development of GASS project white papers
- WCRP CLIVAR: Earth Energy Imbalance: more details will be provided next time.

Workshops and Meetings

List of Workshops and Meetings Held in 2018

Meeting title, dates and location

- 2018 UMAP 2nd PanGass Meeting Feb 26 - Mar 2, 2018, Lorne, Australia; a GEWEX News article (Zeng and Klocke 2018) was published to summarize the outcome.
- 2018 UTCC PROES Workshop, Oct 22 - 23, 2018, Paris, France. A GEWEX News article (Stubenrauch et al. 2019) will be published in February 2019.
- 2018 LS4P Workshop, Dec 8-9, 2018, Washington D.C., USA; a GEWEX News article (Xue et al. 2019) will be published in February 2019.

List of Workshops and Meetings Planned in 2019 and 2020

Meeting title, dates and location and anticipated travel support needs

- 2019 UCP Meeting (with the Gray Zone workshop), Feb 25 – Mar 1, 2019, Berlin, Germany
- GASS panel meeting in the second half of 2019, co-located with a GASS project meeting
- WGNE meeting 23-27 September 2019, Offenbach, Germany
- CFMIP meeting 1-4 October 2019, Mykonos, Greece
- WWRP SSG, November 2019, Geneva, Switzerland

- There will be additional GASS meetings to be planned by individual GASS projects
- The requested travel budget would be \$15K/year (request emailed to Peter van Oevelen)

Other Meetings Attended on Behalf of GEWEX or Panel in 2018

- WWRP Geneva, Switzerland in October 2018; Klocke gave a GASS update
- DOE ARM/ASR Vienna, Virginia, USA in March 2018; Zeng gave a GASS update and discussed collaborations
- ACPC Boulder, USA in April 2018; Zeng gave a GASS update and discussed collaborations
- GEWEX Canmore, Canada in May 2018; Klocke and Zeng helped to organize the conference
- CFMIP Boulder, USA in October 2018; Zeng gave a GASS update and discussed collaborations
- WGNE Tokyo, Japan (per video conference) in October 2018; Klocke gave a GASS update

Publications during Reporting Period

List of Key Publications

- Zeng, X., D. Klocke, B.J. Shipway, M.S. Singh, I. Sandu, W. Hannah, P. Bogenschutz, Y. Zhang, H. Morrison, M. Pritchard, and C. Rio, 2018: Future Community Efforts in Understanding and Modeling Atmospheric Processes, *Bull. Amer. Meteor. Soc.*, doi: 10.1175/BAMS-D-18-0139.1.
- Zeng, X., and D. Klocke, 2018: Understanding and Modeling Atmospheric Processes: the 2nd Pan-GASS Meeting, *GEWEX News*, p. 19, February/May 2018 Issue.