GEWEX Global Atmospheric System Studies (GASS)

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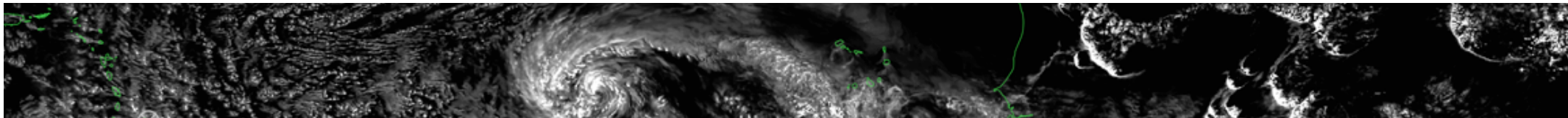

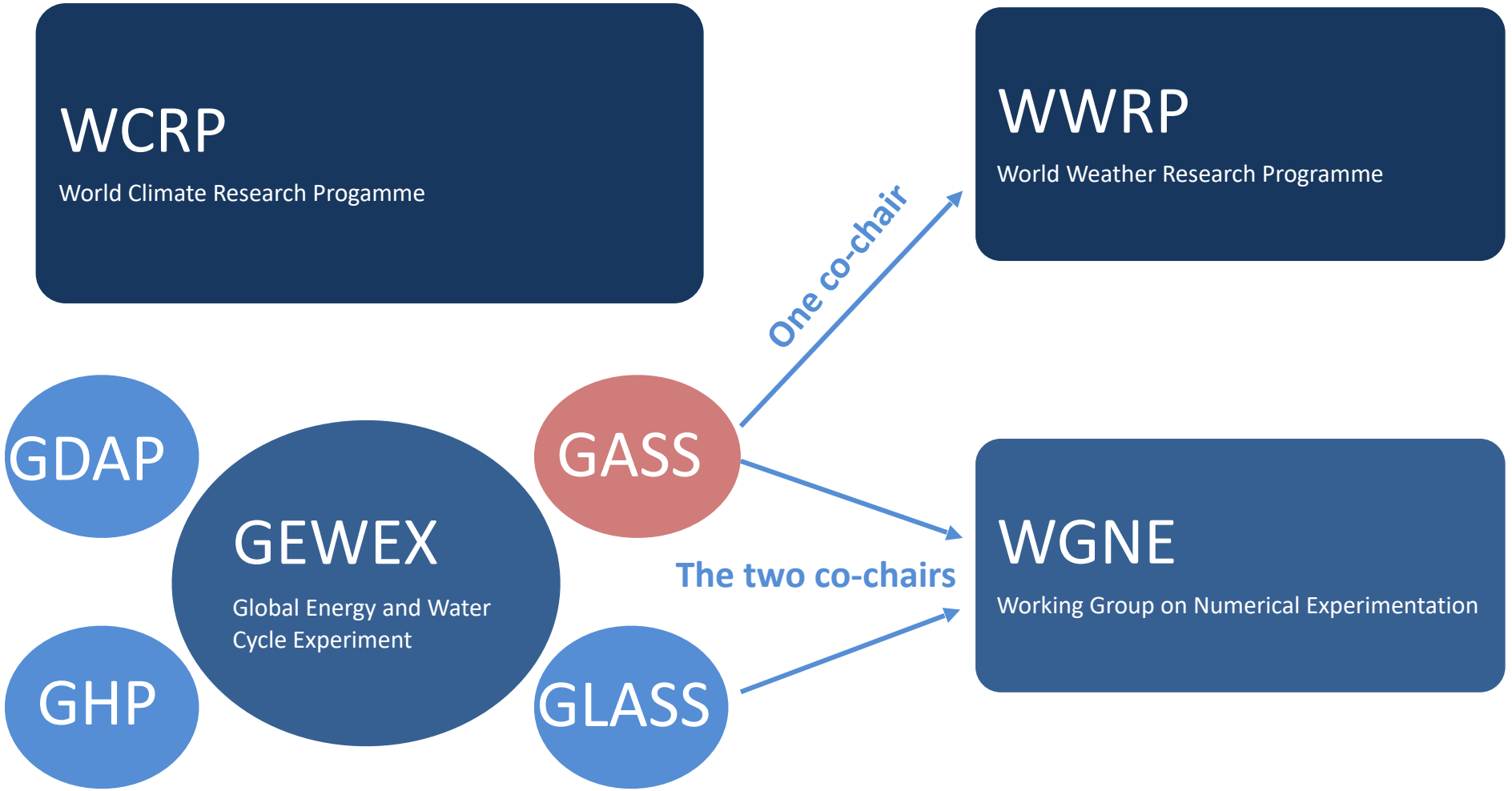

GASS Global Atmospheric System Studies

Science Objectives and Activities

Scientific Objectives of GASS:

to improve the understanding of physical processes in the atmosphere and their coupling to atmospheric dynamics.

Activities of GASS:

To facilitate and support international projects that use observations, process studies, and numerical model experiments to develop and improve the representation of the atmosphere in weather and climate models.

At present, GASS has four active projects with two more starting up.

Additional two more projects (UTCC PROES and GAP) are affiliated with GASS.

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Project: Surface drag and momentum transport project

COnstraining ORographic Drag Effects (COORDE):

Goal: Understanding the effects of resolved and parametrized orographic drag through the COORDE-nation of different modeling groups.

Results were submitted by 8 modeling centers, paper published in JAMES (van Niekerk et al. 2020.
-> impact of resolved orographic drag is similar across models. This gives faith in using the high resolution simulations to constrain parameterizations.

-> The parameterized orographic drag impact is diverse across models in terms of magnitude and position.

-> robust signal of insufficient/misplaced gravity wave drag in lower stratosphere in most models.

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Project: LES and NWP fog modeling inter-comparison project

Demistify: LES and NWP fog modelling inter-comparison:

Motivation: Most operational NWP centers will list errors in fog forecasting amongst their top model problems, with the requirement for improvement considered high-priority. Aviation is the key customer driving this.

Results were submitted from 12 modeling centers, paper in preparation.
-> significant variations between models.

-> Not more consistency for LES than SCMs, suggesting microphysics & radiation as key causes (and not turbulence).

-> representation of cloud droplet sedimentation important. Aerosols not so important.

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Project: LS4P

Impact of initialized land temperature and snowpack on S2S prediction (LS4P):

Goal: This project intends to address two questions:

(1) What is the impact of the initialization of large scale LST/SUBT and snow pack, including the aerosol in snow, in climate models on the S2S prediction over different regions?

(2) What is the relative role and uncertainties in these land processes versus in SST in S2S prediction? How do they synergistically enhance the S2S predictability?

This project focuses more on the process understanding and predictability rather than the operational S2S prediction.

Results were submitted by 20 modeling centers, paper submitted to GMD (Xue, et al.)
-> High elevation land surface and subsurface temperatures in the Third Pole region have substantial predictive capability for precipitation on S2S time-scales.

-> Impact on precipitation anomalies is global.

Project: diurnal and sub-diurnal precipitation

Improving the simulation of the diurnal and sub-diurnal precipitation over different climate regimes:

Goal: to understand what processes control the diurnal and sub-diurnal variation of precipitation over different climate regimes in observations and in models and to identify the deficiencies and missing physics in current GCMs to gain insights for further improving the parameterization of convection in GCMs.

Multiple phases: Interaction between convection and water vapor; Nocturnal convection over land; Diurnal cycle of convection over ocean; Convection transition

Results are being submitted
-> Simulations are ambitious, SCM case, GCM, CRM, LES

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Project: UTCC PROES

GEWEX Upper Tropospheric Clouds and Convection Process Evaluation Study (UTCC PROES):

Goal: advance our knowledge of climate feedbacks of UT clouds; therefore gain a better understanding of the interconnection between the convection and the properties of the outflowing anvils. The focus may be widened to the role of cirrus originating from in situ freezing driven by large-scale forcing, via a link to the Stratosphere-troposphere Processes And their Role in Climate (SPARC) Project

Key results:

- Cloud System Analysis allows process studies by relating anvil properties to convection & provides new observational metrics to further constrain model parameterizations.

- The emissivity structure of mature convective systems changes with convective depth, with more surrounding thin cirrus

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Connections of GASS

- Four projects are in the productive phase. Experiments are submitted analysis are being performed, first papers are written. The projects are related to the top three errors from WGNE Systematic Error Survey Results Summary
  --- Precipitation diurnal cycle, intensity and frequency
  --- Surface fluxes and temperature diurnal cycle
  --- Cloud microphysics

- GASS interacts closely with other groups coordinating model development: GLASS, WGNE and WWRP

- Collaboration and support from the DOE ARM:
  --- observations will be used in GASS projects
  --- support for GASS-related meetings
  --- host GASS data, currently tested with data from the Demistify project

Project: Second Phase of the "Grey Zone" Project

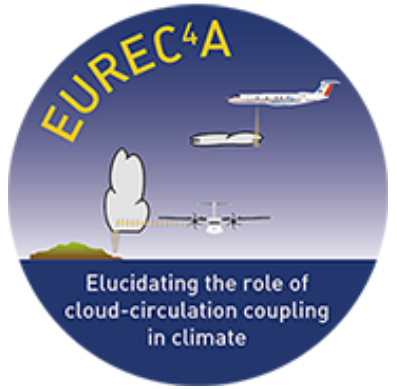
Second Phase of the "Grey Zone" Project: Scale-awareness, stochasticity and convective organization

Partnership: joint with WGNE. also related to the WCRP CFMIP project. Has gone through iterations with international programs (WGNE, WWRP) and the GASS community.

Goal: 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.

Progress: Experiments are being defined, based



Jan/Feb 2020

Investigate how shallow cumulus clouds respond to changes in their large-scale environment

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Coming up…

- New GASS co-chair
- PanGASS conference: Oct. 18 – 22, 2021 in Monterey, CA
  Analysis contest with prize to attend meeting (ESiWACE, GEWEX, ARM)
- Future Projects: Second Phase of the “Grey Zone”, Physics-dynamics coupling
- GASS involvement in WCRP lighthouse activities

Thank you!

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