GEWEX GASS (Global Atmospheric System Studies) Annual Report

Reporting Period: August 2011 – October 2012

Starting date: GCSS and GASS combined at the end of 2010 to form GASS.

URL: http://www.gewex.org/gass_panel.html

Chair(s) and term dates: Jon Petch (end March 2014) and Steve Klein (end March 2015)

Panel Activities: GASS facilitate and support the community who carry out and use observations, process studies and numerical model experiments with a focused goal of developing and improving the representation of the atmosphere in weather and climate models. It aims to address this primarily through the coordination of scientific projects which bring together experts from around the world who can contribute to the development of atmospheric models. GASS primarily oversees intercomparison projects based around observational field campaigns or more idealised studies which typically take from two to five year from initiation to completion with publication of the results.

In the past year the primary activity was the planning, organization and execution of the 1st pan-GASS meeting (see meetings below).

Projects Status including new projects: GASS has 11 current and planned projects; one project was completed in the past year. Newer projects of note include:

- a collaboration with GLASS on land-atmosphere interactions
- the examination of interactions of moist processes parameterizations with the large-scale circulation under the Weak-Temperature Gradient approximation. This effort will be joint with WGCM/EUCLIPSE
- the Grey-Zone intercomparison project which will examine how model parameterize convective processes when the model horizontal resolution only partially permits convective clouds to be simulated (2-10 km range).

For more detail on these and all of the GASS projects see the supplemental material to this report.

Contributions to GEWEX Grand Science Questions and WCRP Grand Challenges: GASS is currently planning to be an active participant under the WGCM-led Clouds and Climate Sensitivity Grand Challenge project. There are numerous ways in which GASS will be an active participant as current (Low-Cloud Feedbacks) and new (the Weak Temperature Gradient) projects will make significant contributions to identified research challenges listed in the white paper for this Grand Challenge. The Grey Zone and Microphysics projects are also expected to play a role in this Grand Challenge.

GASS is the key group internationally who support the coordination of work to improve our understanding and representation of physical processes in the atmosphere – this directly leads to improvements of weather and climate prediction systems. Therefore GASS activities are a critical underpinning component of all the GEWEX Grand Science Questions. GASS projects can be indirectly linked to specific GCs. For example, the current project involving the analysis of the simulation of the MJO by models is related to predictions of precipitation. Also the cloud microphysics project is related as it studies the microphysical evolution of clouds including the precipitation formation process. However, these links are not the critical drivers of these projects and GASS plans to continue to focus their energies on the key underpinning activities of improving the representation of atmospheric processes in weather and climate models. Indeed, we are confident that if models improve their simulations of the key processes we study then the specific phenomena listed in the Grand Science Questions will markedly improve.

Meetings: GASS held the 1st Pan-GASS science conference 10-14 September 2012 in Boulder, CO. Attendance was around 220, including those who came for the simultaneous meeting of the GEWEX Land-Atmosphere System Studies (GLASS) panel. At the Pan-GASS meeting, all GASS projects were discussed in afternoon break-out sessions that followed the morning plenary presentations. For this meeting about $49,000 was raised to support student travel expenses; organizations that contributed funds to this purpose included WCRP, NASA, NOAA, DOE, and NSF. NCAR is thanked for providing the meeting space and the time of administrative assistants to organize the meeting. The GEWEX project office is also thanked for their support of this meeting with its help in website support and the lobbying of WCRP for travel funding.

No current meetings are planned for the next year; more likely individual projects may have meetings in conjunction with other planned meeting. The SSC would like to hold the next pan-GASS meeting in three years, in 2015.

Co-operation with other WCRP projects: GASS maintains various interactions with other bodies. These include: (a) The vertical structure and diabatic heating of the MJO project is conducted jointly between GASS and the WCRP-WWRP MJO task force, (b) GASS is supervised in part by WGNE and presents reports to the annual WGNE meetings, (c) the Low-Cloud Feedbacks project (CGILS) has been conducted jointly with the CFMIP project of WGCM, (d) A GASS SSC member, Gunilla Svensson, has been attending the meetings associated with the new Polar project initiatives of WWRP and WCRP. (e) GASS is represented by Steve Woolnough on the joint WWRP/WCRP seasonal prediction project.

Key Publications: Please see the list of publications provided in the progress reports of the individual projects below.

GASS Science Steering Committee (SSC): GASS is managed by it SSC which holds a telecon usually every 4-8 weeks. Each project will have a GASS SSC member as a sponsor and typically at least one project lead who may not be part of the SSC. Current members of the SSC include: Chris Bretherton, Ann Fridlind, Christian Jakob, Adrian Lock, Hugh Morrison, Robert Pincus, Pier Siebesma, Gunilla Svensson, and Steve Woolnough. There is not a formal term length for the membership of SSC although it is felt that 4 years is a good length to review member's contributions. In the past year, Bjorn Stevens stepped down from the SSC.

Archiving needs: GASS continues to have a requirement for a resource to archive their project data. This will need IT equipment to deliver data over the internet and human resource to do the work in gathering and documenting the cases. This has in the past been done at an ad-hoc level for the working groups (to a mixed level) but as we have moved away from having WGs then there is now no system to ensure our valuable case studies are easily available to the community.

SUPPLEMENTAL MATERIAL: Progress reports of GASS projects

The following pages present progress reports for activities in the reporting period involving planned, current, and recently completed projects. The projects reported on include:

- Stable Boundary Layers
- Weak Temperature Gradient
- Grey-Zone
- Microphysical Modeling
- Low Cloud Feedbacks (CGILS)
- Land-Atmosphere Interactions
- Radiative Processes in Observations and Models
- Mid-latitude Cirrus
- Polar Clouds
- Stratocumulus-to-Cumulus Transition
- Vertical Structure and Diabatic Processes of the MJO
- Convective Systems: TWP-ICE

STABLE BOUNDARY LAYERS

SSC sponsor: Gunilla Svensson
Project leads: Gunilla Svensson and Bert Holtslag
Project status: Mature (for GABLS3), Early (for GABLS4)

a. Accomplishments

The third GABLS intercomparison, based on a case selected Cabauw, the Netherlands, with the aim to study the model's performance for the LLJ development, morning and evening transitions and surface-atmosphere coupling. The intercomparison consists of a SCM and a LES case coordinated by Fred Bosveld and Sukanta Basu, respectively. The latter is focusing on a shorter time span than the SCM. Two papers on the SCM case have been submitted to Boundary-Layer Meteorology. The LES case focusing on the morning transition is also in the writing phase. Main findings from these studies are that the LES is able to capture the transition fairly well after considerable effort was put on the case setup. The SCM results show large variability and strong sensitivity to the forcing provided and the results are analyzed using a method which allows the interpretation of differences among models in terms of the dominating physical processes in the stable boundary layer, i.e. coupling to the soil, turbulent mixing and long wave radiation. Substantial differences among models are found in the representation of these three processes.

b. Activities for next 1-2 years

A new model intercomparison case with even stronger stability than been the case in the previous studies are discussed and being prepared in a small group formed at the workshop in November. The case is based on Antarctic data and some preliminary regional modeling has already been performed by the project lead Timo Vihma. The proposition has been presented and discussed at two meeting during summer 2012, the AMS BLT and the Pan-GASS meetings, and further investigations will be done before releasing the case as an intercomparison study, possibly during spring 2013.

Other activities include the involvement in the land-atmosphere interactions project (see this report) and a proposed intercomparison study for mixing of tracers in boundary layers, likely based on already documented cases as well as new more idealized ones where we expect both the LES and SCM communities to be involved

c. List of key publications

ECMWF, Reading, Workshop report, 2012. Available at:
http://www.ecmwf.int/publications/library/do/references/list/201111

Basu, S., et al., 2012, GABLS Intercomparison of Large-Eddy Simulation models with Cabauw observations. In preparation for Boundary Layer Meteorology.

Bosveld F.C., P. Baas, E. van Meijgaard, E.I.F. De Bruijn, G.-J. Steeneveld and A.A.M. Holtslag (2012). The third GABLS intercomparison case for model evaluation, part A: Case Selection and Set-up. Submitted to Boundary Layer Meteorology.

Bosveld F.C., P. Baas, G.-J. Steeneveld and A.A.M. Holtslag et al. (2012). The third GABLS intercomparison case for model evaluation, part B: Single Column Model results and Process Understanding. Submitted to Boundary Layer Meteorology.

Holtslag, A.A.M., G. Svensson, P. Baas, S. Basu, B. Beare, A.C.M. Beljaars, F.C. Bosveld, J. Cuxart, J. Lindvall, G.J. Steeneveld, M. Tjernström, and B.J.H. Van De Wiel , 2012: Diurnal cycles of temperature and wind – A challenge for weather and climate models . Submitted to Bulletin of the American Meteorological Society.

d. List of Meetings

A workshop was held together with ECMWF at their premises in Reading, UK 5-8 November 2011. The workshop titled "Diurnal cycles and the stable atmospheric boundary layer" attracted about 60 participants from Europe and other parts of the world, such as Japan, North and South America and

Australia. Conclusions and recommendations are found in the workshop report and new studies are initialized and a result of that.

e. Planned meetings, workshops

The aim is to release the Antarctic case such that a first workshop on the results can be held during 2013, likewise with the tracer study.

WEAK TEMPERATURE GRADIENT

SSC sponsor: Steve Woolnough
Project leads: Steve Woolnough, Adam Sobel, Sharon Sessions
Project status: Formation

a. Accomplishments

During Summer 2012 discussion began between the project leads on a proposal for a GASS sponsored project on methods of representing the interaction between convection and the large-scale dynamics in process models through parametrizations of the large-scale circulation. This led to a breakout session at the Pan-GASS meeting in Boulder, September 2012 at which the proposal was discussed and a draft project specification was developed.

b. Activities for next 1-2 years

During the next 6 months the project specification will be finalized and an invitation to participate advertised. The project is expected to start in Spring 2013 with analysis beginning in late summer 2013.

c. List of key publications

d. List of Meetings

e. Planned meetings, workshops

The following meetings have been proposed:

- Kick-off meeting in Spring 2013
- Likely meeting in Autumn/Winder 2013-14 to discuss initial analysis

GREY ZONE

SSC sponsor: Pier Siebesma
Project Committee: Pier Siebesma, Andy Brown, Christian Jakob, Jeanette Onvlee.
Case Leaders: Paul Field, Adrian Hill, Stephan de Roode, Pier Siebesma, Verena Grutzun, Axel Seifert.
Project Status: Early

a. Accomplishments

WGNE has recently expressed the need to organize a systematic evaluation project of atmospheric models that operate in the so called Grey Zone Resolution range of 1~10km. As a response a Grey Zone Project has been established and the project committee has performed a survey and came with the conclusion that especially from the mesoscale model community there was a strong preference to select a cold air outbreak as a first intercomparison study for the Grey Zone Project.

The Case leaders have worked over the last 12 months to set up a cases for a full hierarchy of models (global, LAM and LES) based on observations from the CONSTRAIN experiment during which a classic cold air outbreak over the North Sea north of Great Brittain was observed. Realistic high resolution simulations with the correct classic spatial mesoscale features with 2 independent LES models have been produced.

As a result the case will be released early October after the MPI Hamburg group has come up with a output list for the Global model experiments

b. Activities for next 1-2 years

The following activities are planned for this project:

- October 2012: Release of the Cold Air Outbreak as a first part of the Grey Zone
- Early 2013: Deadline for submission of model results
- Late 2013: Workshop on intercomparison results

c. List of key publications

d. List of Meetings

e. Planned meetings, workshops

A meeting is envisioned to occur in Late 2013 to discuss the results of the first cold air outbreak intercomparison, possibly in conjunction with another GASS meeting.

MICROPHYSICS

SSC sponsor: Hugh Morrison
Project leads: Ben Shipway, Adrian Hill
Project status: Mature

a. Accomplishments

The 2-dimensional KiD model was released in this period (http://appconv.metoffice.com/microphysics). It provides both 1D or 2D kinematic cases. The KiD model was documented in a publication in QJ (see below). Other publications using Kid are listed at http://appconv.metoffice.com/microphysics/publications.shtml.

b. Activities for next 1-2 years

An intercomparison of warm rain microphysics using the 2D-KiD will be organized and conducted. The differences between models of differing complexity will be investigated. This activity will be combined into a joint activity with Cloud Modelling Workshop aerosol processing case. A publication for this work will be written in the next year.

c. List of key publications

Shipway, B.J. and Hill, A.A, 'Diagnosis of systematic differences between multiple parametrizations of warm rain microphysics using a kinematic framework.' Q.J.R. Meteorol. Soc.. doi: 10.1002/qj.1913.

Bretherton, C., A. Fridlind, H. Morrison, and B. Shipway, 2010: GCSS workshop on microphysics and polar/precipitating clouds. GEWEX News, 20, no. 4, 17-19.

Shipway, B.J. and Hill, A.A., 2011, The Kinematic Driver model (KiD), Met Office Technical Report No. 549

d. List of Meetings

Participants working on this project met at the Cloud Modelling Workshop (CMW) in Warsaw, 2012.

e. Planned meetings, workshops

No meetings are currently planned.

CFMIP-GASS INTERCOMPARISON OF LES AND SCMS (CGILS): LOW CLOUD FEEDBACKS

SSC sponsor: Chris Bretherton and Adrian Lock
Project leads: Minghua Zhang, Peter Blossey, Chris Bretherton
Project status: Mature

a. Accomplishments

CGILS was formulated in 2008 to help understand physical mechanisms of low cloud feedback in climate models, and why these feedbacks differ substantially across models. The strategy has been to use an observationally-grounded column modeling framework to intercompare subtropical marine boundary layer cloud response to idealized climate changes between different LES and SCMs, based on theee GPCI locations with representative summer cloud regimes: S12 (well-mixed Sc), S11 (Cu under Sc) and S6 (trade cumulus). The climate perturbation ('P2S') studied in the Phase 1 of CGILS was a 2 K SST increase, a corresponding moist-adiabatic increase of free tropospheric temperature, and an 11% decrease in mean subsidence. After some iteration, 15 SCMs (representing single-column versions of many of the world's leading climate models) and 6 LESs submitted final results, described in a set of papers submitted in July 2012. For the S12 case, the LESs ran a variation 'P2' on the climate perturbation with no subsidence change, and one LES also considered other climate perturbations.

The cloud response of the SCMs scattered widely between each other and away from their parent GCMs. Because of the smallness of the climate perturbation and the use of steady forcings, the SCMs responses were distorted by locking of cloud features to discrete grid levels. In general, models and cases with active shallow cumulus parameterizations tended to show positive cloud feedbacks. After harmonization of the radiation and surface flux schemes, the LES models produced more similar responses. Without subsidence, all LESs showed cloud thinning in the warmer climate, but reduced subsidence counteracted this to varying degrees in the different models. Thus LES suggested that the overall cloud feedback is the net result of multiple compensating cloud responses. In the shallow cumulus case the LES equilibrium cloud-layer depth was also sensitive to microphysics.

b. Activities for next 1-2 years

The next 1-2 years, comprising Phase 2 of CGILS, will focus on two main activities, to be organized by the current leaders of CGILS. The first activity is designed to help interpret and support GCM simulations of rapid adjustment to a step CO2 increase. All participating SCM and LES models will conduct a sensitivity experiment to quadrupling CO2 with no change in surface or free-tropospheric temperature, using the same protocol as in Phase 1.

The second activity is to run all SCMs and LESs forced by realistically time-varying forcings extracted from ECMWF analysis that reflect natural synoptic variability at the S6 (trade Cu) location, not with the steady climatological forcing used in Phase 1. The goal is to make a better connection between the column modeling results and global simulations and observed climatology, and to see how the transient variability affects simulated cloud feedbacks. The S6 location was chosen because the cloud layer is deeper and the required LES resolution is coarser than at the other CGILS points, lessening the issues of vertical under-resolution and grid locking (for SCMs) and overwhelming computational expense (for LES). A pilot SCM-only version of this activity was carried out by some SCMs in phase 1, but only with transient vertical motion, not fully realistic forcings. Brient and Bony (2012) showed the value of a modified version of this CGILS case for interpreting global cloud feedbacks in a French GCM.

Lastly, Pier Siebesma and Sara Del Gasso of KNMI encouraged interested CGILS participants to participate a 'parameter space' sensitivity study of SCM/LES simulations of an idealized steadily-forced marine boundary layer to the inversion jumps of temperature and humidity. For now, this will be regarded as a EUCLIPSE activity, but it may later be revisited as a possible GASS or CGILS project.

c. List of key publications

M. Zhang and 39 co-authors, CGILS: First Results from an International Project to Understand the Physical Mechanisms of Low Cloud Feedbacks in General Circulation Models. Bull. Amer. Meteorol. Soc, submitted 07/2012.

M. Zhang, C. S. Bretherton, P. N. Blossey, Sandrine Bony, Florent Brient and Jean-Christophe Golaz, The CGILS Experimental Design to Investigate Low Cloud Feedbacks in General Circulation Models by Using Single-Column and Large-Eddy Simulation Models. J. Adv. Model. Earth Syst., submitted 07/2012.

P. N. Blossey, C. S. Bretherton, M. Zhang, A. Cheng, S. Endo, T. Heus, Y. Liu, A. Lock, S. R. de Roode and K.-M. Xu, Marine low cloud sensitivity to an idealized climate change: The CGILS LES Intercomparison. J. Adv. Model. Earth Syst., submitted 07/2012.

C. S. Bretherton, P. N. Blossey and C. R. Jones, Mechanisms of marine low cloud sensitivity to idealized climate perturbations: A single-LES exploration extending the CGILS cases. J. Adv. Model. Earth Syst., submitted 07/2012.

Brient, F., and S. Bony, 2012: Interpretation of the positive low-cloud feedback predicted by a climate model under global warming. Clim. Dyn., doi:10.1007/s00382-011-1279-7.

d. List of Meetings

Sept. 2012: Afternoon breakout at the 1st pan-GASS meeting (Boulder, CO, USA)

e. Planned meetings, workshops

June 2013: Joint EUCLIPSE/CFMIP meeting to be held at MPI (Hamburg, Germany)

LAND-ATMOSPHERE INTERACTIONS (JOINT WITH GLASS)

SSC sponsor: Adrian Lock
Project leads: Martin Best and Adrian Lock
Project status: Early

a. Accomplishments

This project grew out of the GABLS/ECMWF workshop in Nov 2011 where there was a consensus that the atmospheric boundary layer and land surface communities needed to work more closely together. At the pan-GASS meeting in Sept 2012, it was proposed to initiate a project, joint between GASS and GLASS, on a clear-sky diurnal cycle case study, from the same observational campaign as was used for GABLS2. The period chosen consists of 3 full diurnal cycles covering a range of different stable boundary layer regimes. The intercomparison would, initially, have three components. Land surface models would be run forced by observed atmospheric variables, PBL models would be run forced by observed surface fluxes and stress, and finally the two models would be run coupled. Additionally initial profiles of soil moisture and temperature will be generated by multi-year runs of the land surface model to ensure these are in balance for each model. Overall this project should both promote greater understanding of each model's strengths and weaknesses and also help quantify the importance of coupling the two systems together.

b. Activities for next 1-2 years

The following activities are envisioned for this project:

- Develop case specifications and release to the community by the end of 2012.

c. List of key publications

d. List of Meetings

The timing and location of a workshop to discuss the results is still to be decided.

RADIATIVE PROCESSES IN OBSERVATIONS AND MODELS

SSC sponsors: Lazaros Oreopoulos, Robert Pincus
Project leads: Lazaros Oreopoulos, Robert Pincus and Eli Mlawer
Project status: Formation/Early

a. Accomplishments

The project is new in GASS. It is envisioned as an outgrowth/extension/expansion of the Continual Intercomparison of Radiation Codes (CIRC) project which also resides in GDAP (ex-GRP). CIRC's main accomplishment during the reporting period was the wrap-up of Phase I activities that culminated in the publication of a paper in JGR-Atmospheres.

b. Activities for next 1-2 years

The following activities are envisioned for GASS efforts in Radiation:

- Develop the next suite of cases for CIRC Phase II with possibly greater emphasis on heating rates.
- Collaborate with the "Stable Boundary Layer Project" to investigate discrepancies between measured and modeled downwelling thermal infrared fluxes.
- Collaborate with the "Cirrus Project" to evaluate cirrus-modulated surface radiation fluxes in the modeling intercomparison built around SPARTICUS ARM SGP flights.
- Assess current ability of radiative transfer codes and required future steps towards incorporating the radiative effects of precipitating particles at solar and thermal IR wavelengths.

c. List of key publications

Oreopoulos, L., et al. (2012), The Continual Intercomparison of Radiation Codes: Results from Phase I, *J. Geophys. Res.*, 117, D06118, doi:10.1029/2011JD016821.

d. List of Meetings

e. Planned meetings, workshops

No meetings are currently planned.

MID-LATITUDE CIRRUS

SSC sponsors: Hugh Morrison
Project leads: Andreas Muhlbauer and Thomas Ackerman
Project status: Early

a. Accomplishments

Initiation of the cirrus model intercomparison project based on a case study from the U. S. DOE Small Particles in Cirrus (SPartICus) field campaign. The objective of this case study is to investigate the microphysical and macrophysical evolution and life cycle of a deep-wave cirrus observed over the ARM Southern Great Plains (SGP) site in Oklahoma and to compare simulated cirrus cloud properties and radiative effects among models and with observations. Special emphasis is on the contribution of small ice crystals in cirrus and the role of homogeneous and heterogeneous ice nucleation. Simulations are compared and evaluated with in situ aircraft observations and with various ground-based and space-borne remote sensors. This project specifically targets cloud-system resolving (CSRM) models, cloud-resolving (CRM) models, large eddy simulation (LES) models and single column models (SCM) with advanced cloud microphysics schemes such as multi-moment bulk microphysics parameterizations or bin microphysics schemes. A detailed description of the project can be found at http://www.atmos.washington.edu/~andreasm/case3_midlatitude_cirrus/case3_midlatitude_cirrus.html.

b. Activities for next 1-2 years

The following activities are envisioned:

- Finalize case setup and logistics for participating models
- Analyse model results, focusing on cirrus macrophysical and microphysical properties through detailed intercomparison of models and comparison of models with in-situ and remotely sensed observations
- Draft a paper detailing results from the model intercomparison

c. List of key publications

Muhlbauer, A., W.W. Grabowski, S.P. Malinowski, T. P. Ackerman, G. Bryan, Z. Lebo, J. A. Milbrandt, H. Morrison, M. Ovchinnikov, S. Tessendorf, J.M. Theriault, and G. Thompson, 2012: Eighth International Cloud Modeling Workshop Meeting Summary. *Bull. Amer. Meteor. Soc.*, submitted.

Muhlbauer, A., T. P. Ackerman, J. M. Comstock, M. Deng, G. Diskin, and P. Lawson, 2012: An observationally-based case of mid-latitude cirrus for cloud-permitting and cloud-resolving models. *Geosci. Model Develop., in prep.*

d. List of Meetings

The following meetings have been held for this project:

- January 2012, Introduction of the project during the MACPEX/SPartICus Science Team Meeting (Salt Lake City, UT, USA)
- March 2012, Discussion of the project during the U. S. DOE ASR Science Team Meeting (Arlington, VA, USA) at a breakout meeting on cirrus, where the case was introduced
- July 2012, International Cloud Modeling Workshop (Warsaw, Poland); a breakout session devoted to the cirrus intercomparison project
- September 2012, 1st pan-GASS conference (Boulder, CO, USA); a breakout session on cirrus clouds centered around the intercomparison project including detailed presentations of the case and preliminary results

e. Planned meetings, workshops

No Meetings are currently planned.

POLAR CLOUD

SSC sponsors: Ann Fridlind
Project leads: Mikhail Ovtchinnikov
Project status: Early/Mature

a. Accomplishments

The ISDAC intercomparison project for Arctic mixed-phase boundary layer clouds has been initiated:

- A case description has been finalized and released (https://engineering.arm.gov/~mikhail/ISDAC_F31.html)
- This case is a follow up to previous MPACE and SHEBA intercomparisons, but under different conditions and more constrained model setup
- The case is conducted jointly with the US DOE Atmospheric System Research Program (ASR) and 2012 International Cloud Modeling Workshop (CMW)

b. Activities for next 1-2 years

The following activities are envisioned:

- Complete analysis of submitted simulations
- Focus on attribution of inter-model differences to variations in the treatment of microphysics and dynamics

c. List of key publications

Muhlbauer, A., W.W. Grabowski, S.P. Malinowski, T. P. Ackerman, G. Bryan, Z. Lebo, J. A. Milbrandt, H. Morrison, M. Ovchinnikov, S. Tessendorf, J.M. Theriault, and G. Thompson, 2012: Eighth International Cloud Modeling Workshop Meeting Summary. *Bull. Amer. Meteor. Soc.*, submitted.

d. List of Meetings

The following meetings have been held for this project:

- ASR Science Team Meeting (March 2012, Arlington, VA, USA); at a breakout session on Arctic Clouds the ISDAC intercomparison case was introduced and preliminary results were discussesd
- 2012 International Cloud Modeling Workshop (July 2012 in Warsaw, Poland); a breakout session devoted to the ISDAC intercomparison case
- 1st pan-GASS conference (September 2012, Boulder, CO, USA); a breakout session on Polar Clouds included presentations on and discussion of the ISDAC intercomparison

e. Planned meetings, workshops

No meetings are currently planned.

STRATOCUMULUS-TO-CUMULUS TRANSITION

SSC sponsor: Adrian Lock
Project leads: Stephan de Roode, Irina Sandu, Roel Neggers
Project status: Mature

a. Accomplishments

This project studies the stratocumulus to trade cumulus transition, one that is of climatological importance for understanding low cloud cover variations in the marine subtropics. There are two parallel LES intercomparisons as well as SCM intercomparisons. These intercomparisons are being run in collaboration with a European project, EUCLIPSE. In combination these cases challenge models to produce both a realistic transition compared to detailed in situ data and also a realistic sensitivity of the speed of transition to changes in environmental forcing. Results so far suggest the LES do a good job of capturing these details, although requiring very high (5m) vertical resolution. One of the motivations for this intercomparison was that these transitions would present a particular challenge for SCMs, many of which would need to make the transition between different parameterizations of vertical mixing. Although many SCMs do indeed struggle to generate realistic transitions, it is encouraging that those organizations that have worked hard to develop these aspects of physical parameterizations (invariably using previous GCSS intercomparison cases) can do a much better job. Further work is investigating the difference between forcing the SCM with mean forcing compared to running an ensemble of SCM and taking the mean. Papers are in preparation describing these studies in much more detail.

b. Activities for next 1-2 years

The following activities are envisioned for this project:

- Writing of papers for the project will take place in the next year.

c. List of key publications

De Roode, S.R. et al (2012) LES Results of the GASS-EUCLIPSE Lagrangian Stratocumulus to Shallow Cumulus Transition Cases, *AMS-BLT Conference*, https://ams.confex.com/ams/20BLT18AirSea/webprogram/Manuscript/Paper208663/intercomparison_lags.pdf

Lock, A.P. (2011) GCSS/CFMIP/EUCLIPSE Meeting on Cloud Processes and Climate Feedbacks. *GEWEX News*, August 2011

d. List of Meetings

The following meetings have been held for this project:

- September 2010, Joint workshop with EUCLIPSE on the Transition and CGILS cases held at KNMI (deBilt, Netherlands)
- June 2011, joint meeting with CFMIP and EUCLIPSE including further discussions on the Transition and CGILS cases held at the Met Office (Exeter, Devon, UK)
- April 2012, some discussion of progress alongside an otherwise EUCLIPSE-only meeting at MeteoFrance (Toulouse, France)
- September 2012, Discussion of project at the 1st pan-GASS meeting (Boulder, CO, USA)

e. Planned meetings, workshops

No meetings are currently planned, although work will continue.

VERTICAL STRUCTURE AND DIABATIC PROCESSES OF THE MJO

SSC sponsors: Jon Petch and Steve Woolnough
Project leads: Jon Petch, Duane Waliser, Prince Xavier, Nick Klingaman, Xianan Jiang & Steve Woolnough
Project status: Early

a. Accomplishments

This project is studying the vertical structure of diabatic process in the MJO in global models and its relationship to MJO simulation fidelity using 3 sets of model integrations. 20 year climate simulations; 2-day hindcasts from 2 YoTC MJO cases (E&F) and 20-day hindcasts of the same events. Over the spring/summer of 2012 data submissions for one or more components of the project were received from 23 modelling centres. Preliminary analysis of these models was presented at the Pan-GASS meeting, Boulder, September 2012. At that meeting the decision was made to request centres to perform an additional set of hindcasts for the Nov 2011 MJO observed during the CINDY/DYNAMO campaign, with details forthcoming following additional analysis of the YOTC case and considerations of keeping/altering the experimental framework.

This project is conducted jointly between GASS and the WCRP-WWRP MJO task force.

b. Activities for next 1-2 years

Continued analysis of the three components of the experiment focusing on the diabatic tendencies and their relationship to MJO simulation, including the relationships between forecast skill, climate simulations and details of physical processes and representation. The following activities are envisioned for this project:

- Deadline for submission of model output in time for inclusion in the initial papers is Dec 2012
- Request for CINDY/DYNAMO hindcasts to be performed in Jan 2013 with deadline approximately 6 months later
- Draft papers on each component & model output made publicly available by June 2013
- Synthesis paper and recommendations for future process study Autumn 2013

c. List of key publications

Petch, Jon, Duane Waliser, Xianan Jiang, Prince Xavier, and Steve Woolnough: A Global Model Intercomparison of the Physical Processes Associated with the Madden-Julian Oscillation, 2011, *GEWEX News*, 21, 3-5.

d. List of Meetings

The following meetings have been held for this project:

- 1st pan-GASS meeting in Boulder September 2012 where preliminary results were discussed

e. Planned meetings, workshops

The following meetings have been proposed:

- Proposed Workshop in Spring 2013, possibly attached to WGNE systematic errors workshop
- Proposed workshop in Autumn 2013 to discuss future plans

CONVECTIVE SYSTEMS: TWP-ICE

SSC sponsors: Ann Fridlind & Jon Petch
Project leads: Ann Fridlind, Yanluan Lin, Ping Zhu and Laura Davies
Project status: Finished

a. Accomplishments

This completed project examined simulations of convective clouds in the environment of Darwin, Australia in early 2006. This was the first model intercomparison project to:

- Involve four model types (CRM, LAM, SCM, GAM) with multiple international modelling groups participating
- Use ensemble forcing data in the SCM component

b. Activities for next 1-2 years

The following wrap-up activities are envisioned:

- Submit final 2 publications
- Ensure that lessons learned are applied to future projects

c. List of key publications

Bretherton, C., A. Fridlind, H. Morrison, and B. Shipway, 2010: GCSS workshop on microphysics and polar/precipitating clouds. *GEWEX News*, 20, no. 4, 17-19.

Varble, A., et al. (2011): Evaluation of cloud-resolving model intercomparison simulations using TWP-ICE observations. Precipitation and cloud structure. *J. Geophys. Res.*, 116, D12206, doi:10.1029/2010JD015180.

Fridlind, A. M., et al. (2012), A comparison of TWP-ICE observational data with cloud-resolving model results, *J. Geophys. Res.*, 117, D05204, doi:10.1029/2011JD016595.

Lin, Y., et al. (2012), TWP-ICE global atmospheric model intercomparison: Convection responsiveness and resolution impact, *J. Geophys. Res.*, 117, D09111, doi:10.1029/2011JD017018.

Zhu, P., et al. (2012), A limited area model (LAM) intercomparison study of a TWP-ICE active monsoon mesoscale convective event, *J. Geophys. Res.*, 117, D11208, doi:10.1029/2011JD016447

Petch et al. (2012), An evaluation of intercomparisons of four different types of model simulating convection duringTWP-ICE. To be submitted to *Q. J. R. Met. Soc.*

Davies et al. (2012), A Single Column Model Ensemble approach applied to the TWP-ICE experiment. To be submitted to *J. Geophys. Res.*

d. List of Meetings

There was a plenary talk containing all results at the spring science team meeting of the US DOE ARM/ASR program (March 2012)

e. Planned meetings, workshops

No further meetings for this completed project.