

GEWEX Cloud System Study (GCSS)

Reporting Period: 1 January 2006 - 31 August 2006

Starting Date: 1 January 1993

URL: www.gewex.org/gcss.html

Chair(s) and Term Dates: Christian Jakob (1 January 2004 – 31 December 2007)

Overview:

There are a variety of cloud processes that affect the large-scale behavior of the climate system, but occur on scales too small to be represented explicitly in global numerical models used for climate and weather prediction. Scientists develop numerical representations or parameterizations to represent the behavior of these processes. It is generally recognized that inadequate parameterization of clouds is one of the greatest sources of uncertainty in the prediction of weather and climate. The GEWEX Cloud System Study (GCSS) facilitates the development of better parameterizations of cloud systems for climate models by an improved understanding of the physical processes at work within the following types of cloud systems:

- Boundary layer
- Cirrus
- Extra tropical layer
- Precipitating convective
- Polar

In that context the main objectives of GCSS are:

- To develop the scientific basis for the parameterization of cloud processes with due regard to physical and morphological identity among cloud system types
- To coordinate the acquisition and assimilation of observations and the use of cloud-resolving models in the derivation of cloud system realizations for use in the development of parameterization schemes in large-scale models
- To promote the evaluation and intercomparison of parameterization schemes for cloud processes

Status: Past year activities:

The GCSS working groups and portfolios are all progressing according to their plans. The Boundary Layer Working Group is beginning a new study on the role of precipitation in shallow cumulus clouds based on the Rain In Cumulus over the Oceans (RICO) experiment. The cases for this study have been designed and initial results are becoming available. The Cirrus Working Group remains in a spin-up phase and is currently defining its first study based on an observational case. The Extratropical Layer Cloud Working Group is in the final stages of analyzing their simulations of the ARM March 2000 experiment. Current results identify the inability of GCMs to parametrize the effect of meso-scale circulations in frontal systems on the cloud fields in such systems as a major problem area. The Deep Convection Working Group is in the main phase of conducting their study of the transition from shallow to deep convection over the tropical ocean as part of the MJO. Early results indicate that GCMs develop deep convection too rapidly and with too large an effect on the large scale, not unlike their behaviour in the diurnal cycle. The group is also beginning to address issues related to the role of convection in the Tropical Tropopause Layer (TTL). The chair of the group co-organized the SPARC-GCSS-IGAC workshop on Modelling of Deep Convection and of Chemistry and their roles in the Tropical Tropopause Layer during June 2006 in Victoria, Canada. The workshop was very successful in bringing together the stratospheric dynamics, chemistry and convection modelling community. The formation of a cross-program working group on TTL issues was suggested and a small panel to establish the group was formed. Dr Leo Donner from GFDL is the current GCSS representative on that panel. The Polar Clouds Working Group is continuing on its case study based on recent data from the ARM MPACE experiment. The focus of this study is to better understand and simulate the long-lived mixed-phase clouds frequently found at the top of the Arctic PBL. The Pacific Cross Section Working Group is currently collecting results from the participating GCM groups. Thanks to the strong collaboration of GCSS with WGNE on this project the group has already received results from more than 10 modelling groups and this number is

likely to rise to more than 20. All models that participate in the GHP study on transferability will also participate in this study. The group will meet for the first time in New York in September 2006.

The DIME activity is progressing as planned and several new cases have been added to the DIME library. Funding for the continuation of this activity has been secured by Dr W. Rossow (NASA GISS) and the DIME website will play an increasingly important role in the GCSS activities, such as that on moist process metrics.

Through both the chair and the panel representative for microphysics (Dr U. Lohmann, ETH Zurich) GCSS has become involved in the organization of a cross-communities workshop on cloud-aerosol-precipitation interactions. Other groups involved are iLEAPS and IGAC. Details are sketchy at this stage, but the plan is to hold the workshop in the second half of 2007.

New directions:

GCSS' success so far is based on its focus on process studies carried out in support of parametrization development. Any future direction taken has to build on this success. At the same time GCSS has always had difficulties to involve the GCM community in its activities. Recently taken steps (Pan-GCSS meeting, metrics activity, Pacific Cross Section) have strengthened that link and it is vital to use this momentum to embed GCSS in wider WCRP/COPES activities. The simulation of convection has been identified as a major problem area in climate and NWP models - hence the proposal for a concerted effort in COPES, to which GCSS can contribute its experience and knowledge in conducting process studies.

More recently GCSS has been asked to position itself in the area of cloud-aerosol interaction. While microphysics (at the heart of which are cloud-aerosol interactions) has long been an area of study in GCSS, this was mainly in support of studies of cloud dynamics, which are intimately linked to microphysics. Given the aim of GCSS to improve parameterizations and the increase in the number of parameterization that explicitly deal with cloud-aerosol interactions it is timely to assess the role that GCSS should play in such developments and which of the existing cloud-aerosol activities can provide good partnerships. First steps to align GCSS to better deal with microphysical issues have been taken recently.

Future: Next year foreseen activities:

- Working Group activities continue as normal
- Participation of GCSS scientists in major field experiments (TWP-ICE, AMMA)
- GCSS Panel meeting as part of the Pan-GEWEX Panel meeting in October 2006 in Frascati, Italy
- Joint meeting of the Boundary Layer and Pacific Cross Section Working Groups in September 2006 in New York, USA

Key results:

- The key scientific results of the current Working Group activities have been summarized above (Status section). The main programmatic outcomes of 2006 so far are:
- establishment of a closer link to the GCM community through metrics activity and Pacific Cross Section Working Group
- establishment of a closer link to the cloud-aerosol community through participation in the planning of a cross-community workshop
- establishment of a closer link to SPARC through a joint TTL study as a major outcome of the joint workshop

Issues and Recommendations:

- Despite the continued support of WCRP travel for the GCSS chair and members of the GCSS panel is becoming increasingly difficult. This is likely to need addressing in 2006. A suggestion is the introduction of a Co-Chair for GCSS. This will lead, amongst other things, to a sharing of the travel load.

List of Meetings, Workshops:

January 2006 - Participation in GEWEX SSG meeting, Dakar, Senegal

June 2006 - Joint GCSS/SPARC/IGAC workshop on "Modelling of Deep Convection and of Chemistry and their roles in the Tropical Tropopause Layer" in Victoria, Canada.
September 2006 – Participation in WGCM meeting
September 2006 – Joint meeting of the Boundary Layer and Pacific Cross Section Working Groups in September 2006 in New York, USA.

Planned meetings, workshops:

GCSS Panel meeting as part of the Pan-GEWEX Panel meeting in October 2006 in Frascati, Italy

List of members and their term dates:

Chair: Christian Jakob (1 January 2004 - 31 December 2007)

NWP: Martin Miller (ECMWF)

Climate models: Steve Klein (PCMDI)

LES: Adrian Lock (UKMO)

CRM: Steve Krueger (U Utah)

Field experiments: Tom Ackerman (PNNL)

DIME: William Rossow (NASA GISS)

Metrics: Robert Pincus (NOAA CDC)

Microphysics: Ulrike Lohmann (ETH)

Chair PBL clouds: Pier Siebesma (KNMI)

Chair Cirrus: Steven Dobbie (U Leeds)

Chair Extratropical clouds: George Tselioudis (NASA GISS)

Chair Convection: Jon Petch (UKMO)

Chair Polar Clouds: James Pinto (NCAR)

Chair Pacific Cross Section: Joao Teixeira (NATO)