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## GEWEX Cloud System Study (GCSS) cirrus cloud working group: development of an observation-based case study for model evaluation

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Received: 16 Sep 2011 – Discussion started: 24 Oct 2011 – Revised: 18 Apr 2012 – Accepted: 20 Apr 2012 – Published: 08 Jun 2012

**Abstract.** The GCSS working group on cirrus focuses on an inter-comparison of model simulations ranging from very detailed microphysical and dynamical models through to general circulation models (GCMs). The past GCSS cirrus cloud inter-comparison highlighted the wide range in modelling results that was a surprise to the modelling community. That inter-comparison was idealised and, therefore, a key issue was that it did not benefit from observations to help distinguish between model performances.

In this work, we aim to address this key issue by developing an observationally based case study to be used for the GCSS cirrus modelling inter-comparison study. We focused on developing a case that had sufficient observations with which to evaluate models, to help identify which models in the inter-comparison are performing well and highlight areas for model development. Furthermore, it will provide a base case for future model comparisons or testing of new or updated models. This paper outlines the modelling case development and the inter-comparison results will be presented in a follow-on paper.

The case was based on the 9 March 2000 Atmospheric Radiation Measurement (ARM) Southern Great Plains (SGP) during an intensive observation period (IOP). The case was developed utilising various observations including ARM SGP remote sensing including the MilliMeter Cloud Radar (MMCR), radiometers, radiosondes, aircraft observations, satellite observations, objective analysis and complemented with results from the Rapid Update Cycle (RUC) model as well as bespoke gravity wave simulations used to provide the best estimate for large scale forcing. The retrievals of ice water content, ice number concentration and fall velocity provide several constraints to evaluate model performances. Initial testing of the case has been reported using the UK Met Office Large Eddy Simulation Model (LEM) which suggests the case is appropriate for the model inter-comparison study. To our knowledge, this case offers the most detailed case study for cirrus comparison available and we anticipate this will offer significant benefits over past comparisons which have mostly been loosely based on observations.

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**How to cite:** Yang, H., Dobbie, S., Mace, G. G., Ross, A., and Quante, M.: GEWEX Cloud System Study (GCSS) cirrus cloud working group: development of an observation-based case study for model evaluation, *Geosci. Model Dev.*, 5, 829–843, <https://doi.org/10.5194/gmd-5-829-2012>, 2012.