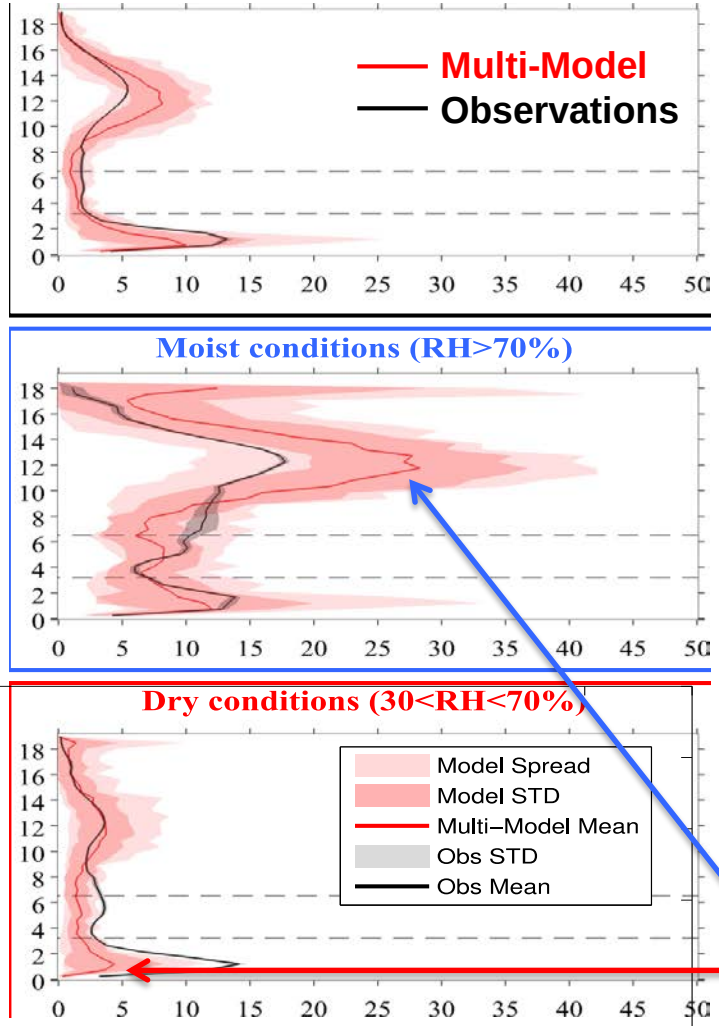
Systematic Biases In The Vertical Structure Of Clouds In Climate Models

Cesana G. and D. E. Waliser (Oct 2016) Characterizing And Understanding Systematic Biases in the Vertical Structure Of Clouds In CMIP5/CFMIP2 Models, *GRL*, DOI: 10.1002/2016GL070515.



Profiles of clouds for observations & models for all (top), moist (middle) & dry conditions (bottom)

Problem

- Very few studies address the ability of the models to represent the vertical structure of clouds, which influences the solar reflective and infrared heat trapping properties of clouds, and in turn the sign and magnitude of cloud-climate feedbacks.

Analysis

- From a traditional low-, middle-, and high-cloud "layered" perspective as well as a more detailed "level" perspective (40 levels), the vertical distribution of clouds in 12 general circulation models (GCMs) are compared against the GCM-Oriented Cloud-Aerosols Lidar and Infrared Pathfinder Satellite Observations Cloud Product (CALIPSO-GOCCP) using a satellite simulator approach.
- Biases in climate models are characterized to determine whether they are systematic or not and to explore their origin.

Finding

- Detailed vertically-resolved observations (**CALIPSO/CloudSat**) are crucial to expose all cloud biases in climate models
- High layered-clouds are horizontally too sparse while at the same time vertically too deep

Too many vertically deep high-clouds in moist environments

Too few low-level clouds in dry environments

Significance

- This study provides guidance for modeling centers to improve their cloud scheme and in turn their GCM (ability to reproduce present and future climate), including NASA GISS model.