

# **RCEMIP**

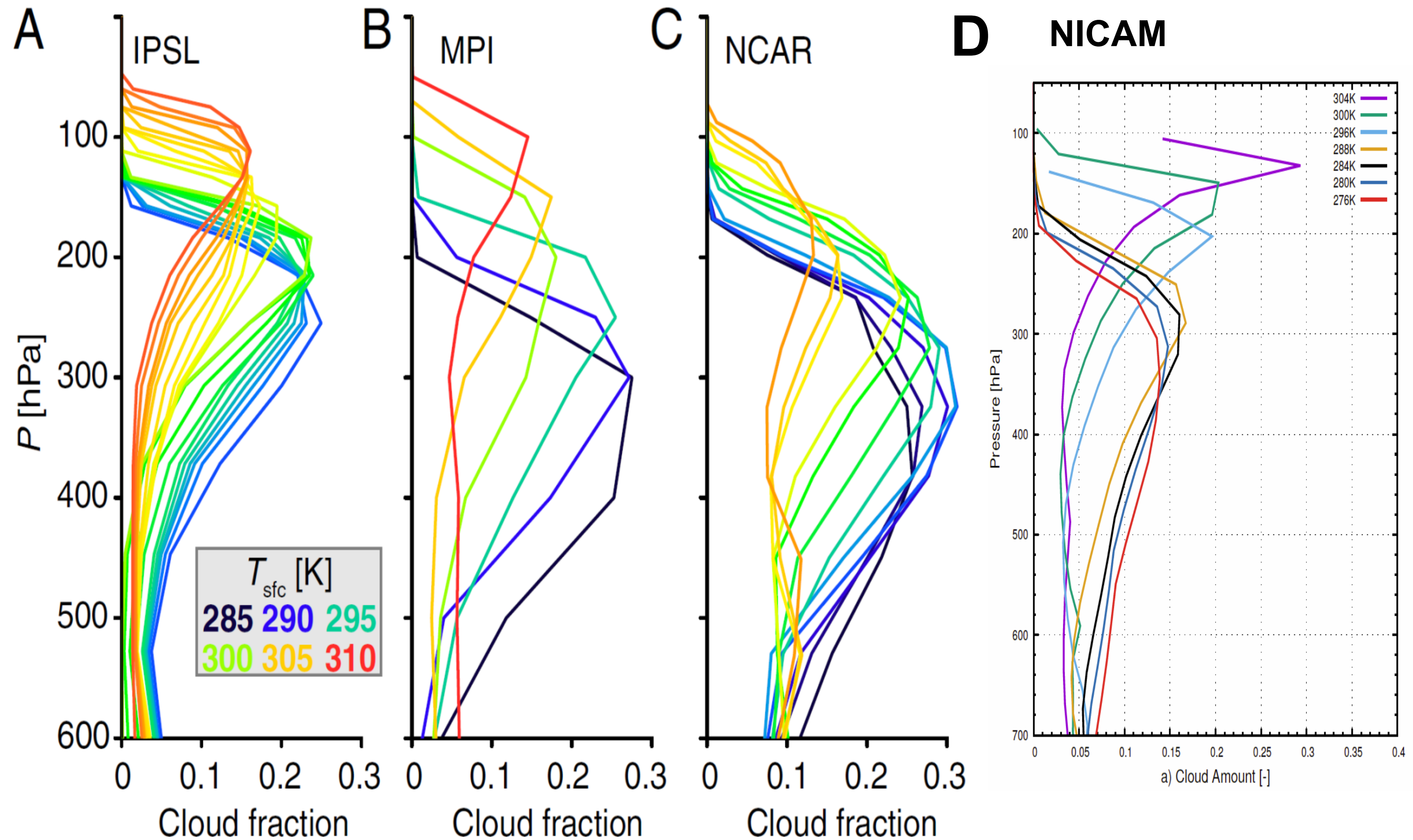
## **Radiative Convective Equilibrium Model Inter-comparison Project**

Wing, A. A., Reed, K. A., Satoh, M., Stevens, B., Bony, S., Ohno, T., 2017: Radiative-Convective Equilibrium Model Intercomparison Project. Geosci. Model Dev. Discuss, <https://doi.org/10.5194/gmd-2017-213>.

The three themes that RCEMIP has been designed for are:

- 1. What is the response of clouds to warming and what is the climate sensitivity of RCE?**
- 2. What is the dependence of the degree of convective self-aggregation and tropical circulation regimes on temperature?**
- 3. What is the robustness of the RCE state, cloud feedbacks, and convective self-aggregation across the spectrum of models?**

The role of convection in cloud feedbacks is central to a better understanding of global and regional climate changes, as pointed out by the WCRP Grand Challenge on Clouds, Circulation, and Climate Sensitivity (Bony et al. 2015).



Vertical profile of the cloud fraction by (A) IPSL, (B) MPI, and (C) NCAR GCMs (Bony et al., 2016) and (d) NICAM for different surface temperatures.

# RCEMIP protocol

Required simulations:

RCE295: RCE simulation with uniform, fixed sea surface temperature (SST) of 295 K.

RCE300: RCE simulation with uniform, fixed SST of 300 K.

RCE305: RCE simulation with uniform, fixed SST of 305 K.

Models

- SCMs (single column models)
- CRMs (cloud resolving models)
  - Square:  $dx=1\text{km}$ ,  $96 \times 96$  grids; 100 days
  - Channel:  $dx=3\text{km}$ ,  $128 \times 2048$  grids; 100 days
- GCMs (general circulation models)
  - 3 years,  $R=R_{\text{earth}}$ ,  $dx$  arbitrary
- GCRMs (global cloud resolving models)
  - GCRM1:  $R=\text{Earth Radius}$ ,  $dx$  arbitrary (3.5, 7, 15, 30, 60 km)
  - GCRM2:  $dx=dx_0=3\text{km}$ ,  $R$  arbitrary (6400, 3200, 1600, 800, 400 km), 100 days

## Diagnostics

cloud fraction, aggregation metrics (organization index, subsidence fraction, and autocorrelation length), moist static energy budgets.

Comments and Suggestions: Please post at the GMDD web page:

Wing et al. 2017: Geosci. Model Dev. Discuss. <https://doi.org/10.5194/gmd-2017-213>

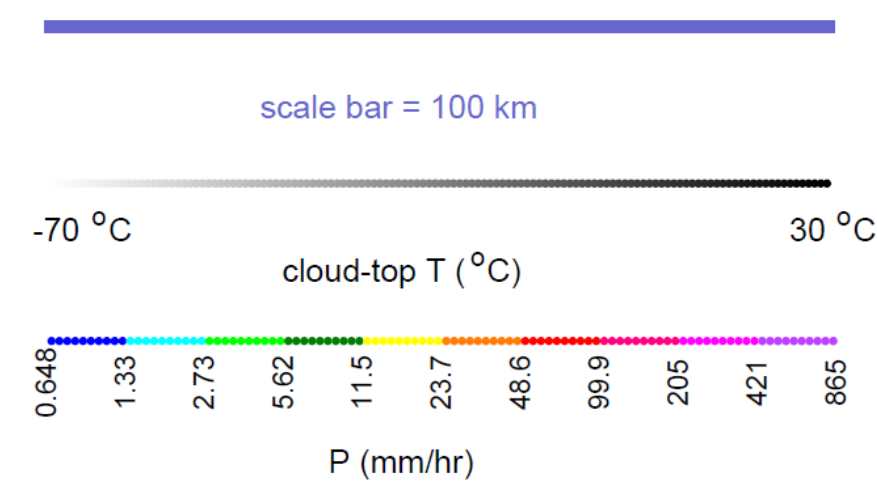
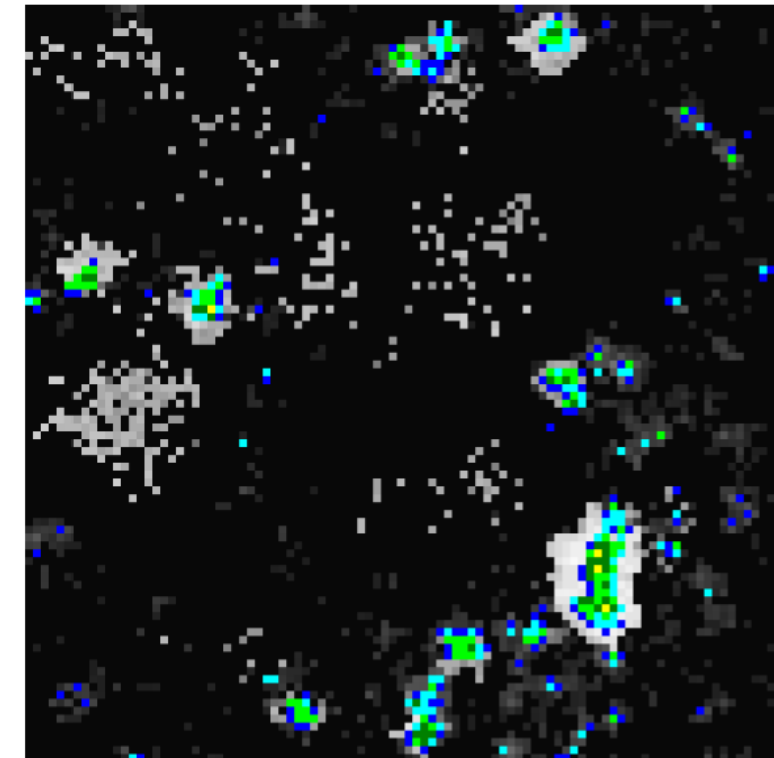
RCEMIP page: <http://myweb.fsu.edu/awing/rcemip.html>



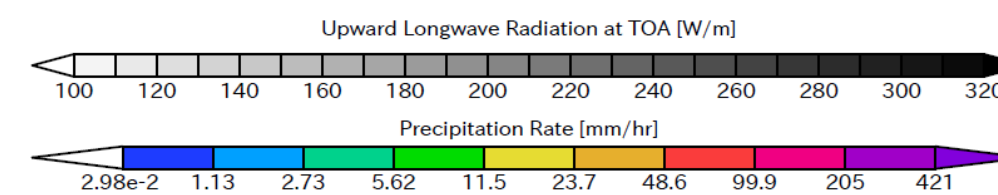
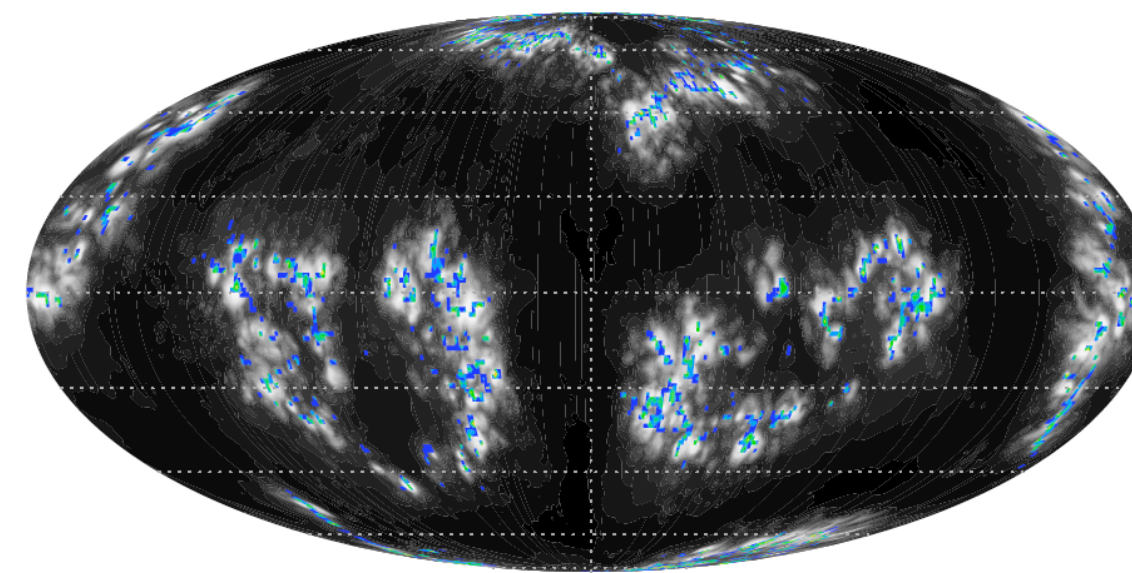
# RCEMIP models: Various types of models can participate in RCEMIP

CRM, square domain SAM  
(96grid x 96grid, dx=1km)

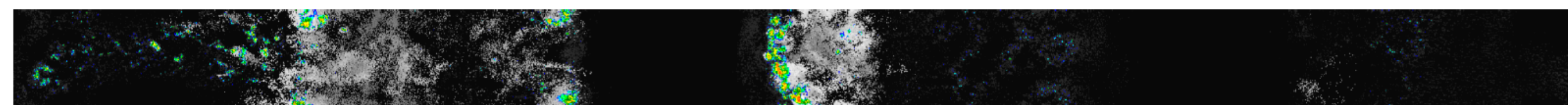
Cloud Top Temperature and Precipitation, Day 90.208



GCRM:  $\Delta x=14\text{km}$ , Earth  
radius NICAM

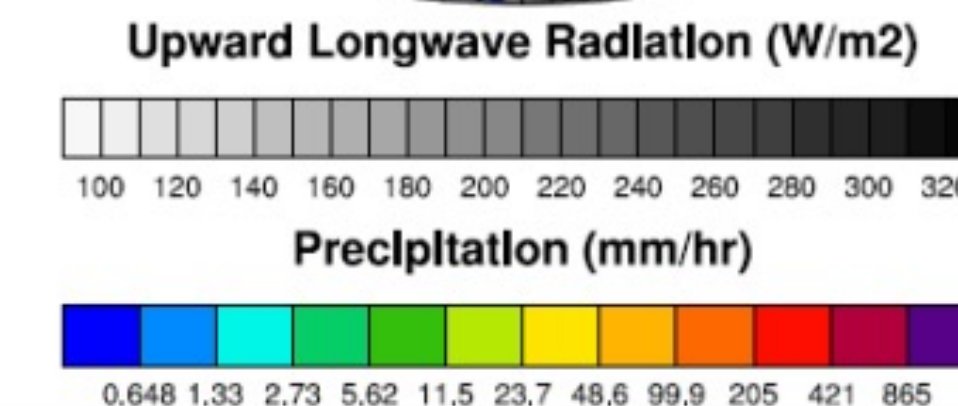
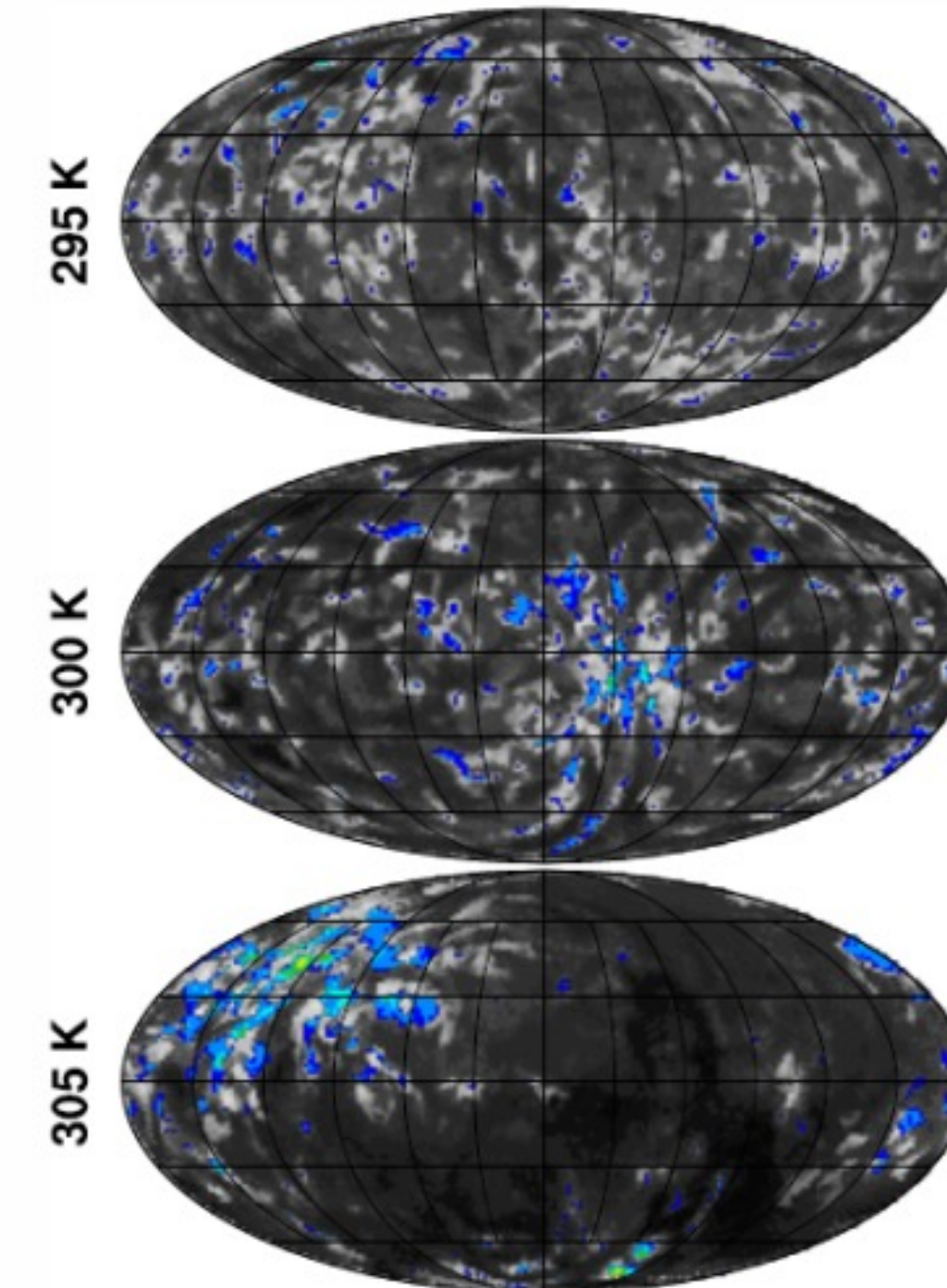


Cloud Top Temperature and Precipitation, Day 90.2083



CRM, channel domain SAM (128grid x 2048grid, dx=3km)

GCM: CAM5, dx~100km



Cloud top temperature (gray shading) and precipitation (color shading) at  $T_s = 300\text{K}$ .  
Note that the scale bar is an order of magnitude different between the three panels.