Large Scale Model Performance in CAP-MBL

Matt Wyant, Rob Wood, Chris Bretherton, and Jennifer Fletcher U. Washington

Cecile Hannay, NCAR

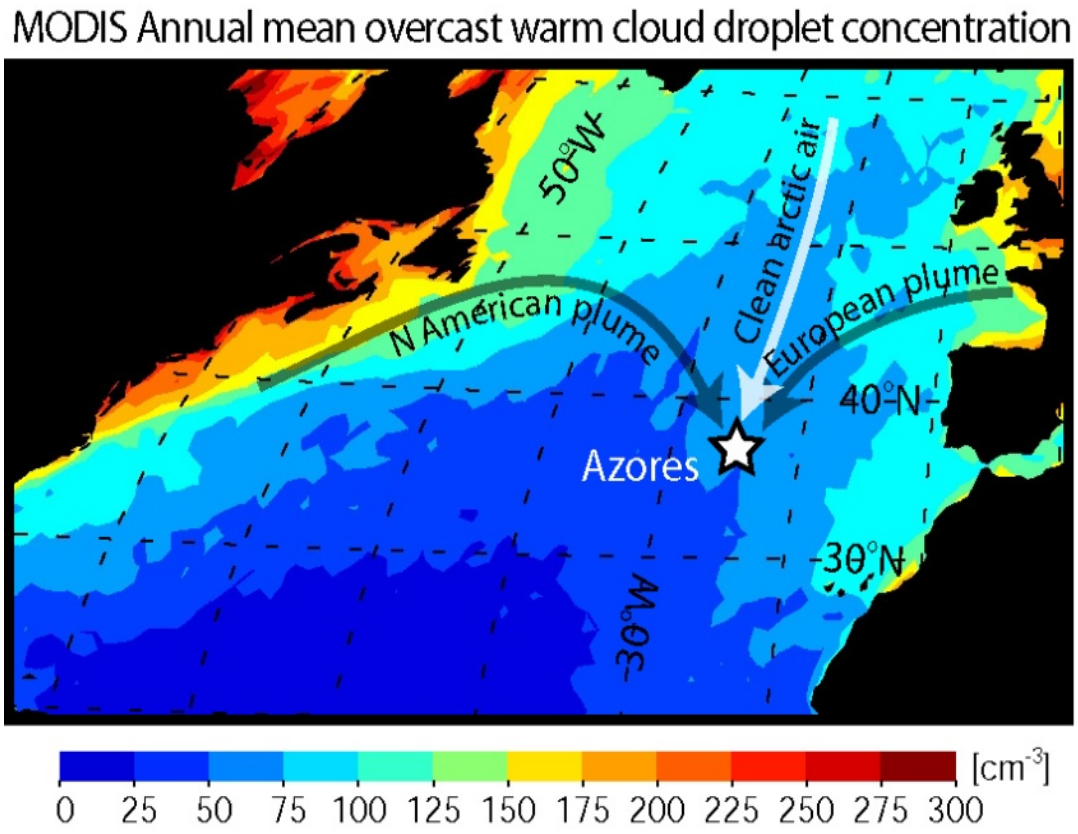
Yanluan Lin, GFDL

CAP-MBL 2009-2010

Diversity of aerosol sources

Diversity of cloud regimes

High time resolution continuous observations for 18+ months

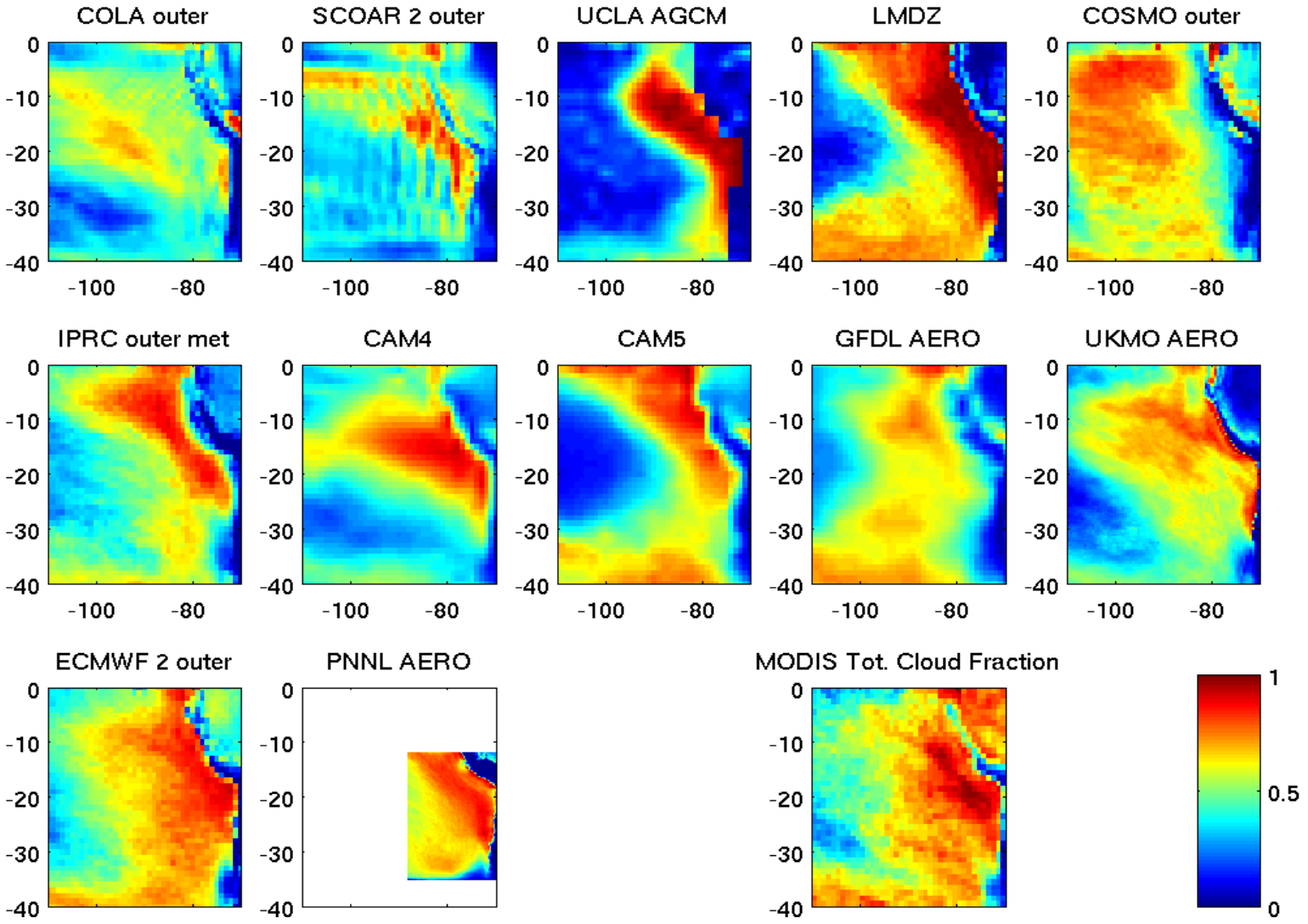


Goal

- How well can large-scale models simulate the lower troposphere at Graciosa?
  - Boundary layer winds/temperature
  - Cloud regime / Bulk cloud properties
  - Aerosol / CCN / Cloud droplet concentrations
  - Aerosol – Cloud – precipitation interactions

VOCA SEP Model Assessment Oct-Nov 2008

Mean Low Cloud Fraction



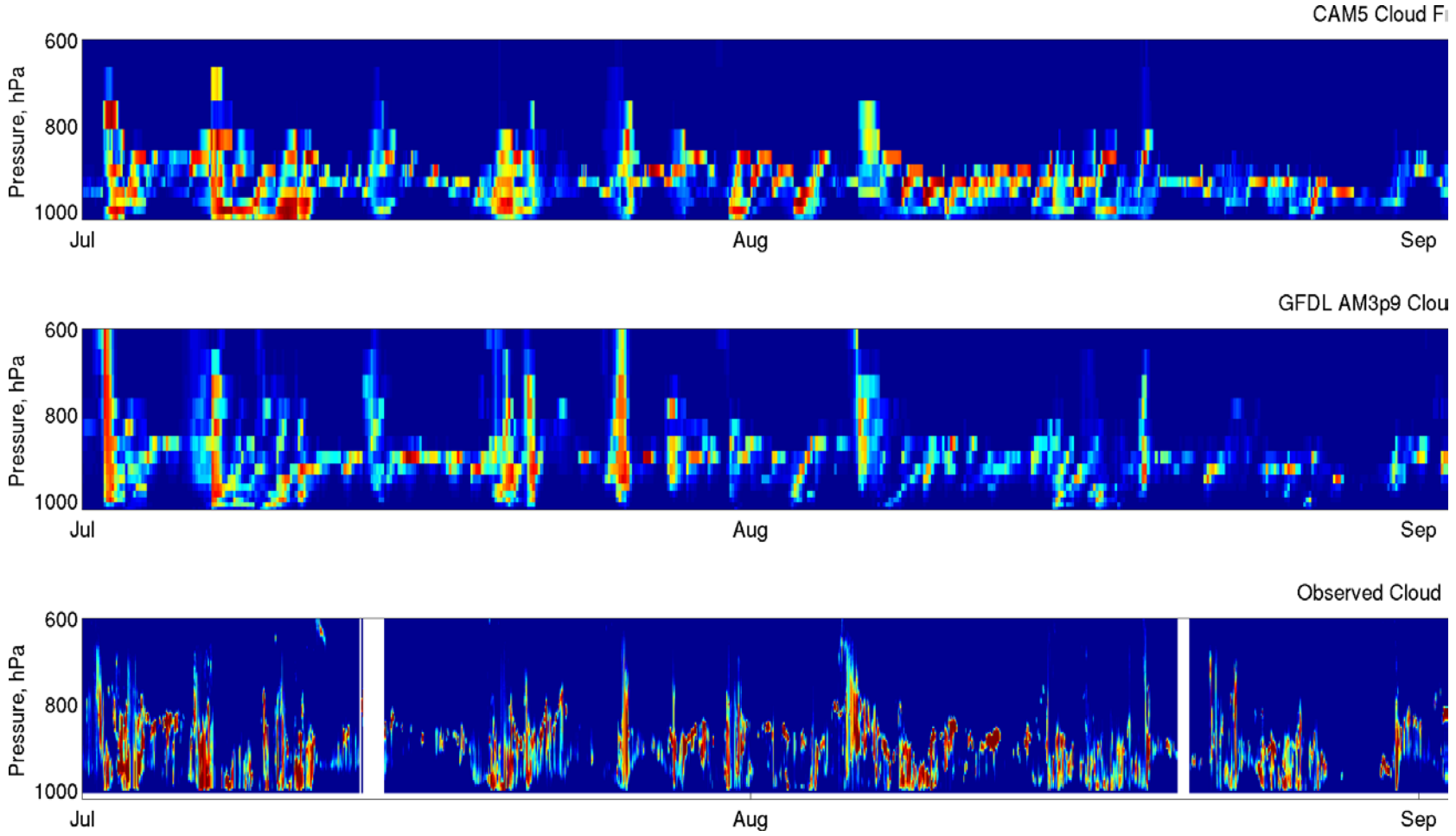
Experiment Setup

- GCM runs initialized with ECMWF YOTC Analysis
- Forecast hours 24-48 analyzed
- Output extracted from nearest grid columns to Graciosa

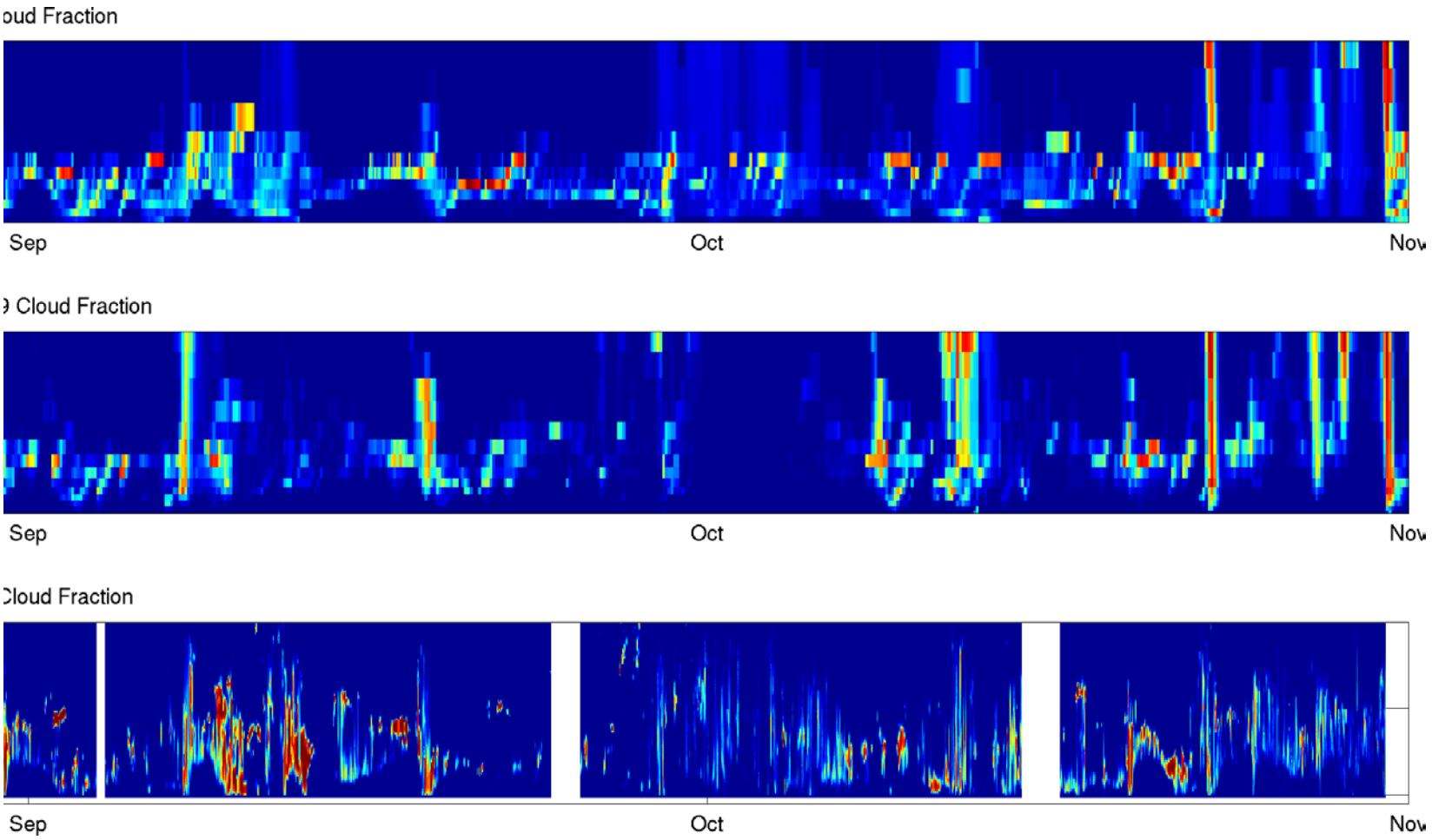
GCMs

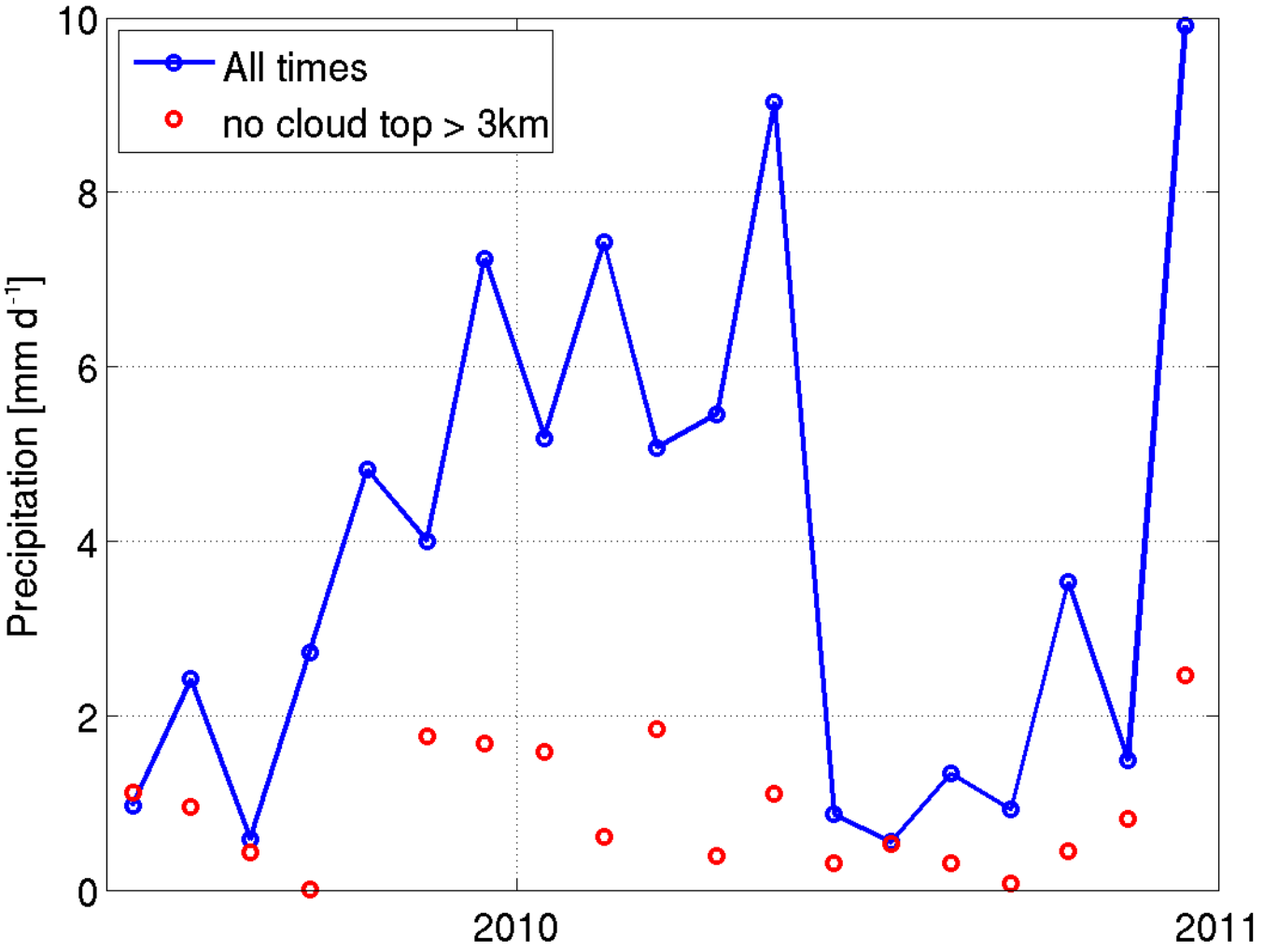
- CAM 5: Interactive prognostic aerosols, Morrison microphysics
- GFDL A3p9: Interactive prognostic aerosols, chemistry not fully active

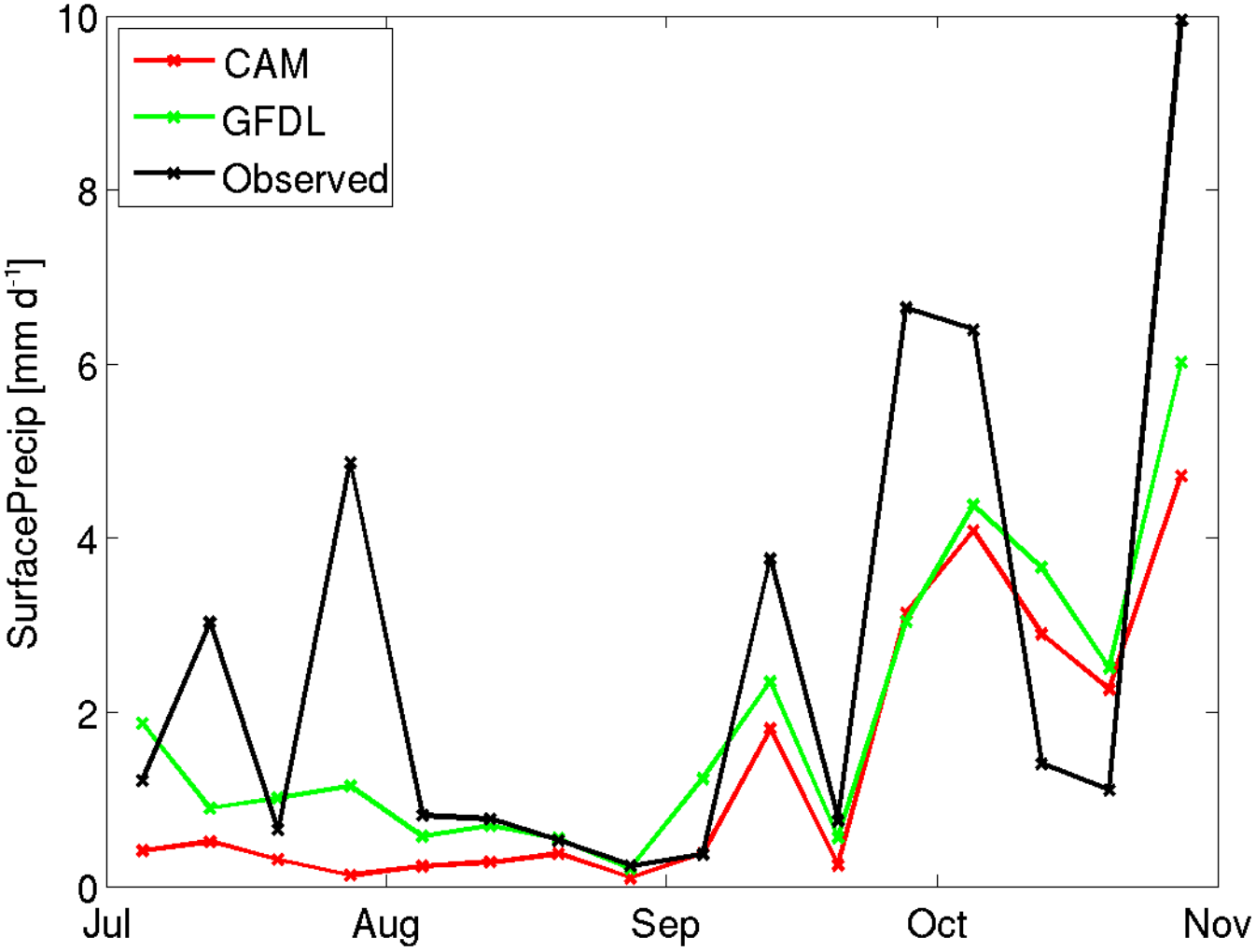
Cloud Fraction

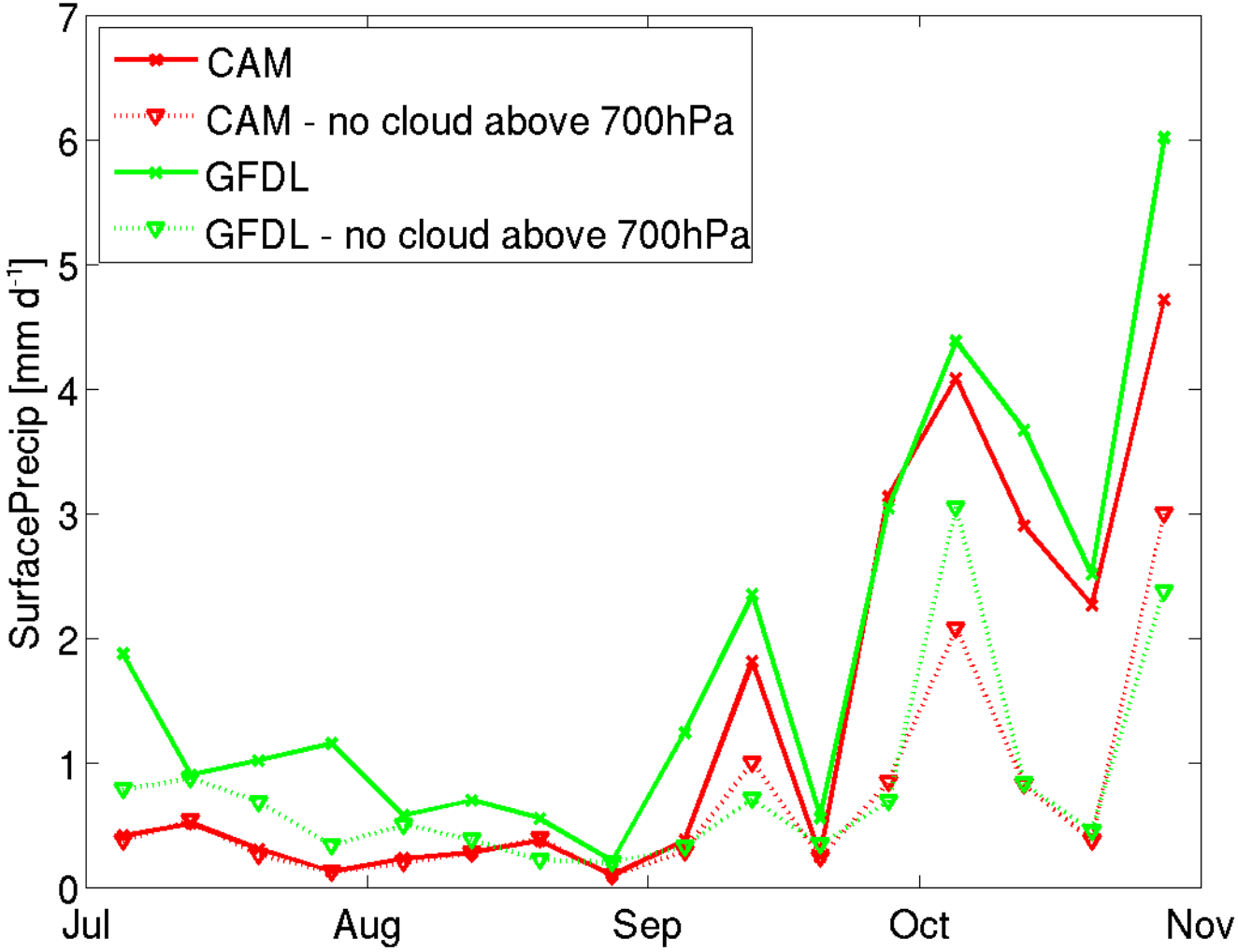


Cloud Fraction

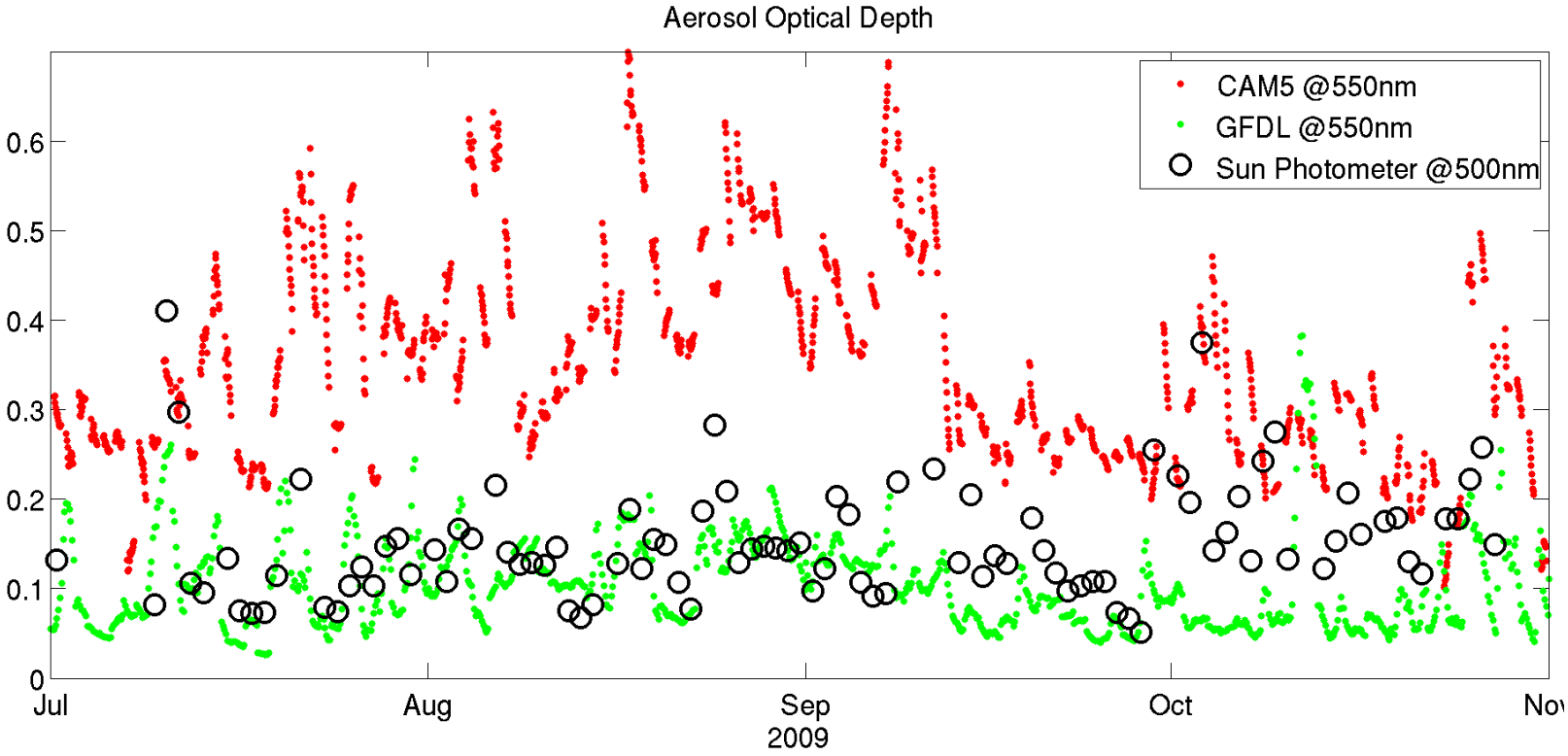



All times
no cloud top > 3km
Precipitation [mm d-1]
10
8
6
4
2
0
2010
2011

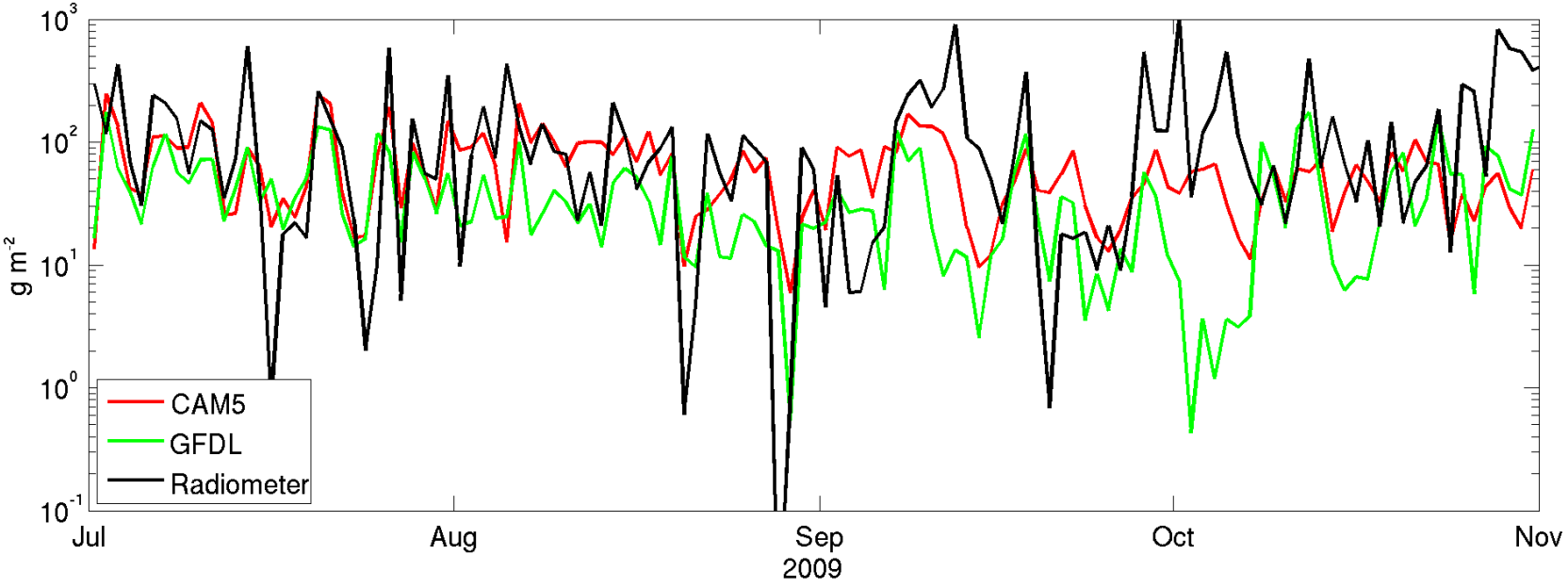

CAM
GFDL
Observed
SurfacePrecip [mm d-1]
0
2
4
6
8
10
Jul
Aug
Sep
Oct
Nov


CAM
CAM - no cloud above 700hPa
GFDL
GFDL - no cloud above 700hPa
SurfacePrecip [mm d-1]
0
1
2
3
4
5
6
7
Jul
Aug
Sep
Oct
Nov

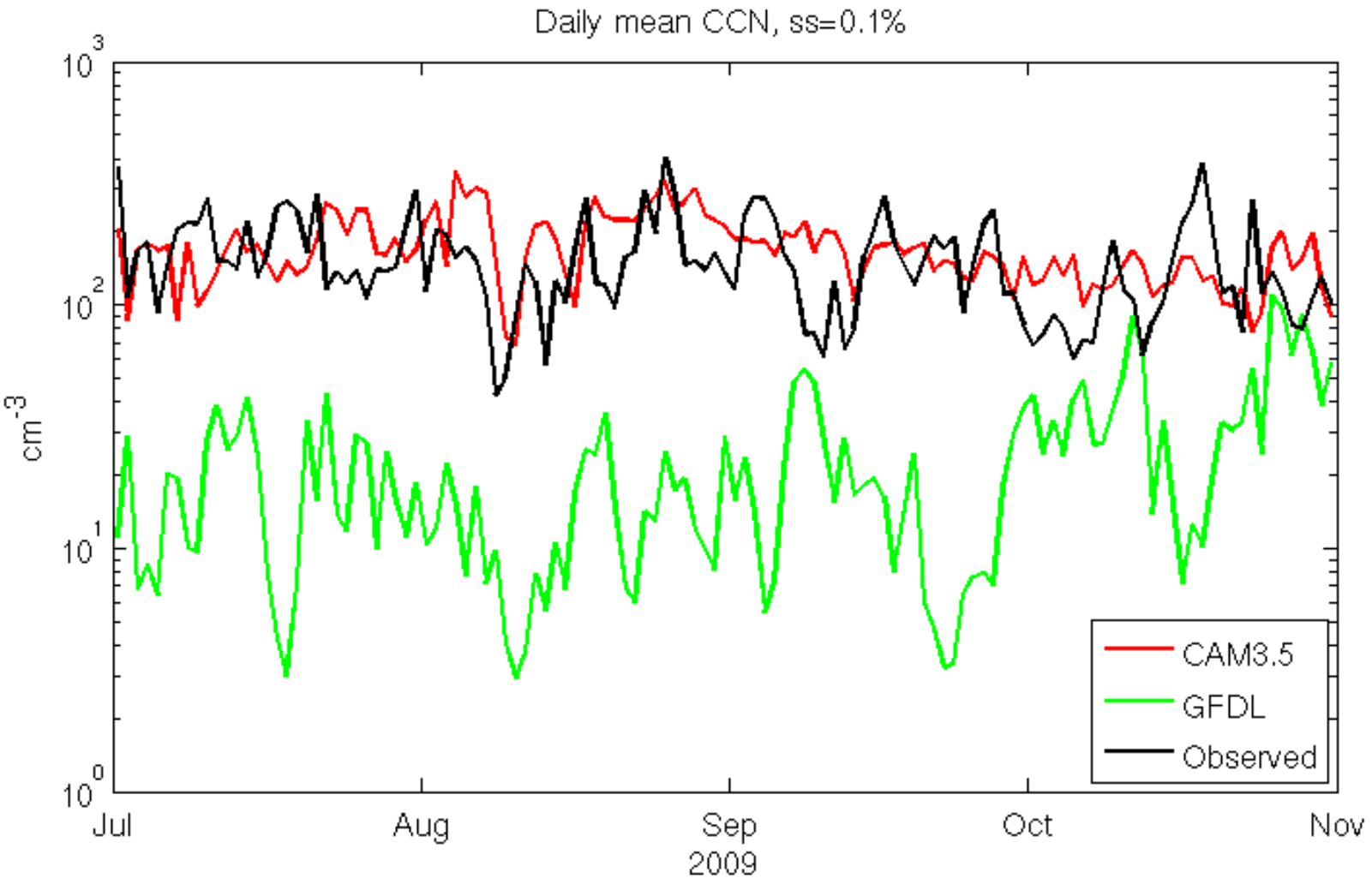
Aerosol Optical Depth



Liquid water path

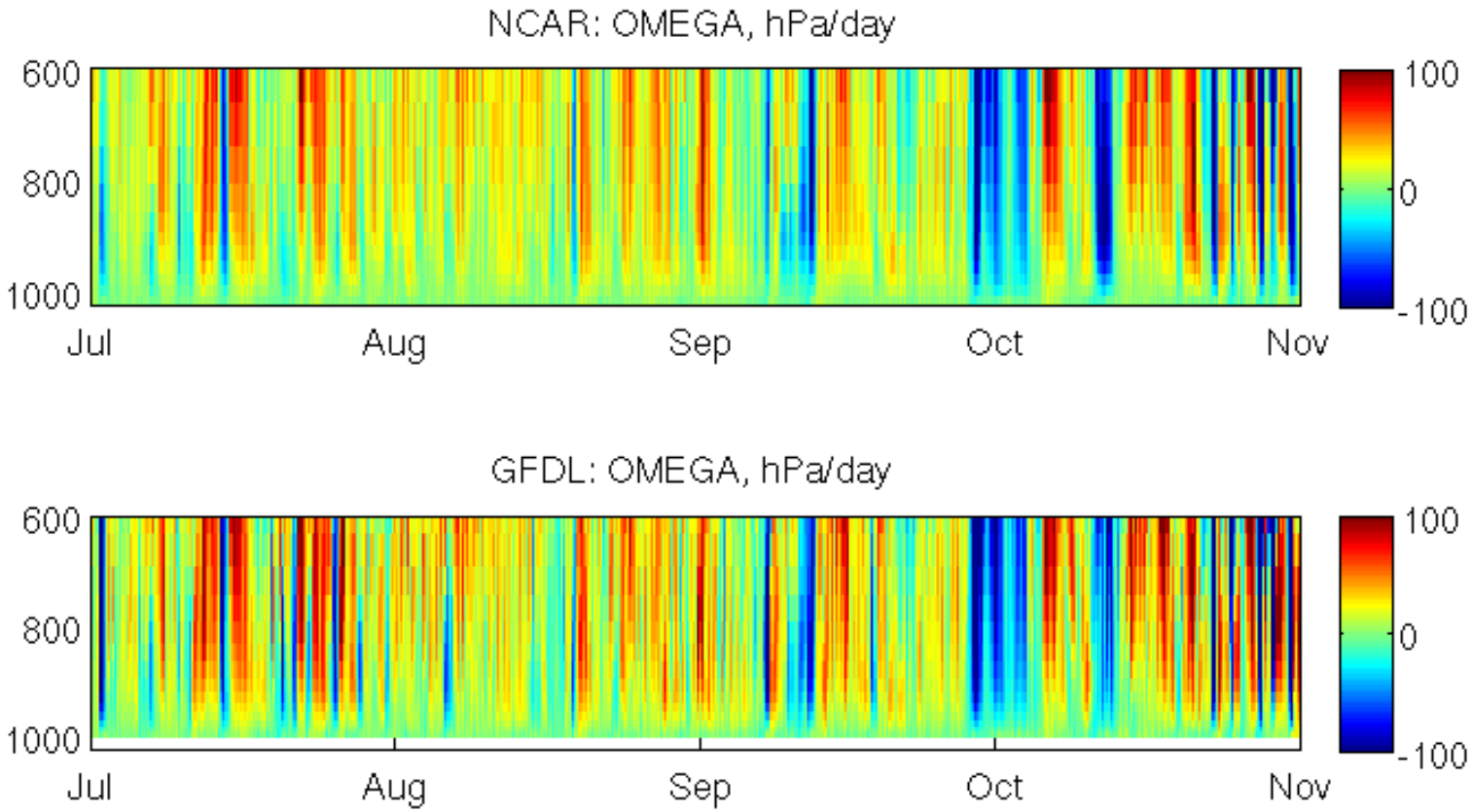


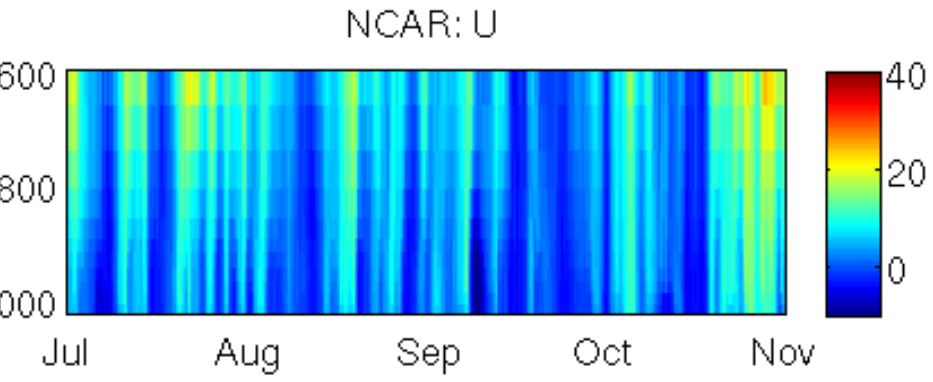
Near-surface CCN

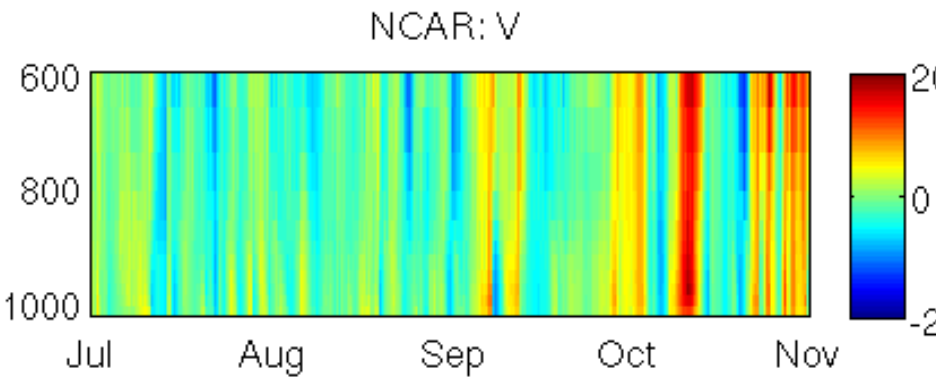


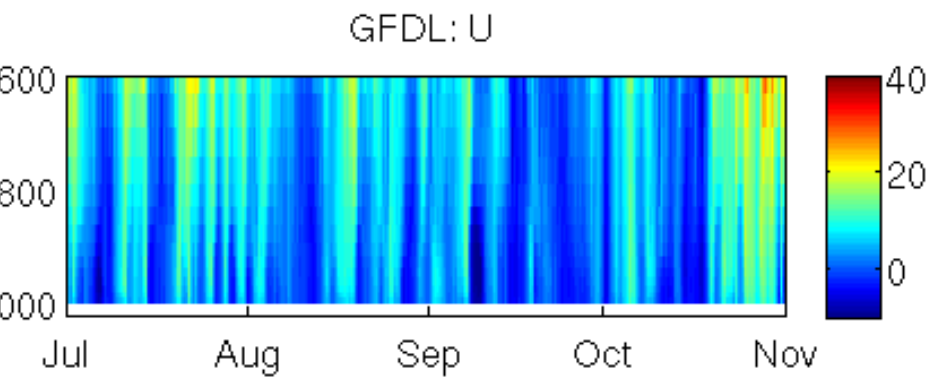
Summary

- GCMs run in forecast mode simulate the clouds in the marine boundary layer reasonably well.
  - Winds, Temperature well simulated
  - Cloud evolution / structure reasonable
- Biases in AOD are seen in the GCM forecasts. Some aspects of seasonal and daily AOD variations are captured.


NCAR: OMEGA, hPa/day
600
800
1000
Jul
Aug
Sep
Oct
Nov
100
0
-100
GFDL: OMEGA, hPa/day
600
800
1000
Jul
Aug
Sep
Oct
Nov
100
0
-100


NCAR: U
600
800
000
40
20
0
Jul
Aug
Sep
Oct
Nov


NCAR: V
600
800
1000
Jul
Aug
Sep
Oct
Nov


GFDL: U
600
800
000
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20
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Jul
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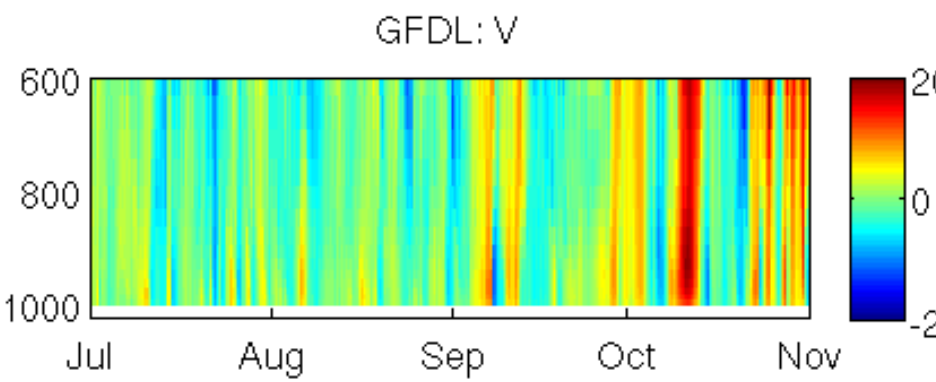
GFDL: V
600
800
1000
Jul
Aug
Sep
Oct
Nov