

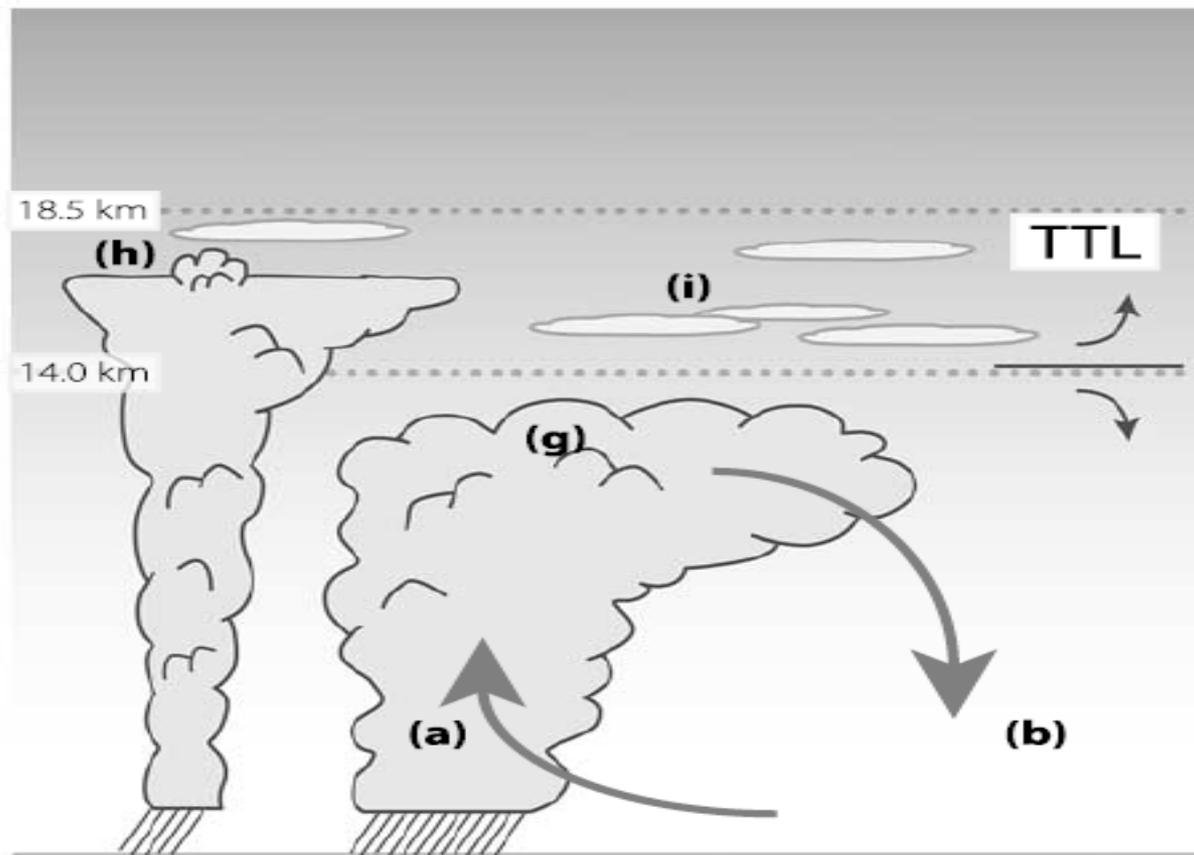
GPS-RO Observations of the Tropical Tropopause Layer: Investigating Cloud-Temperature Interactions with COSMIC

Jeffrey R. Taylor and William Randel

NCAR Earth System Laboratory

Overview

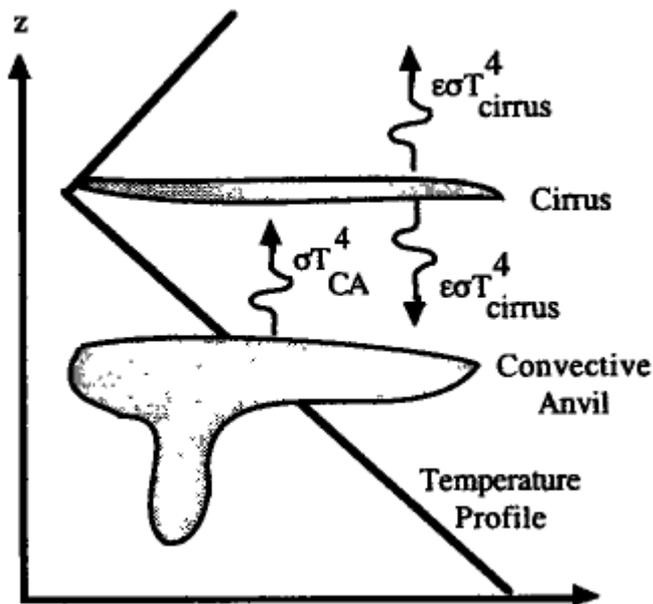
- Cirrus-Temp Background
- Cloud Climatology
- Observations: Case Study
- Remaining Questions



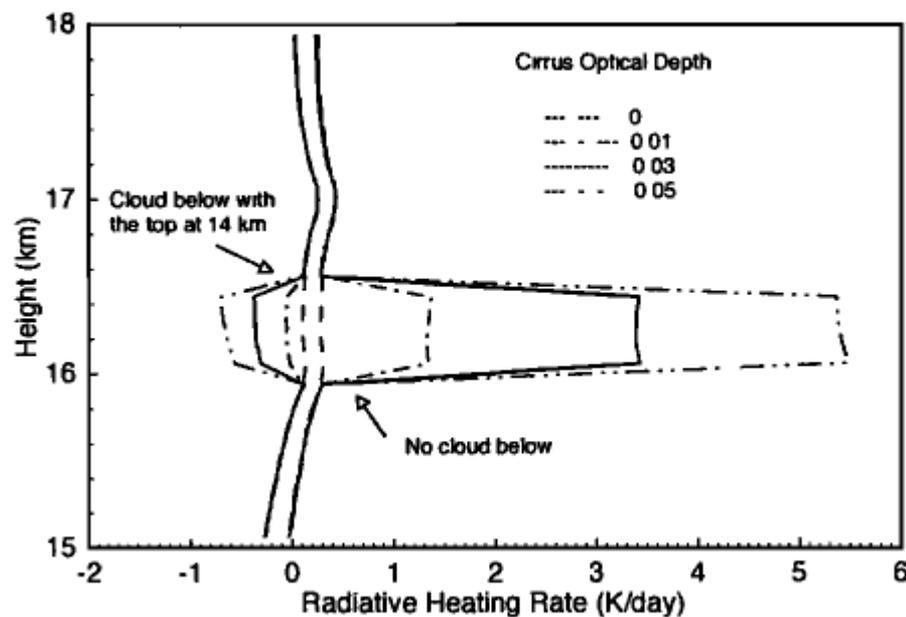
Fueglistaler, *Rev Geophys*, 2009

Cirrus – Temperature Interaction

Clear-sky, longwave heating:
~3 K/day

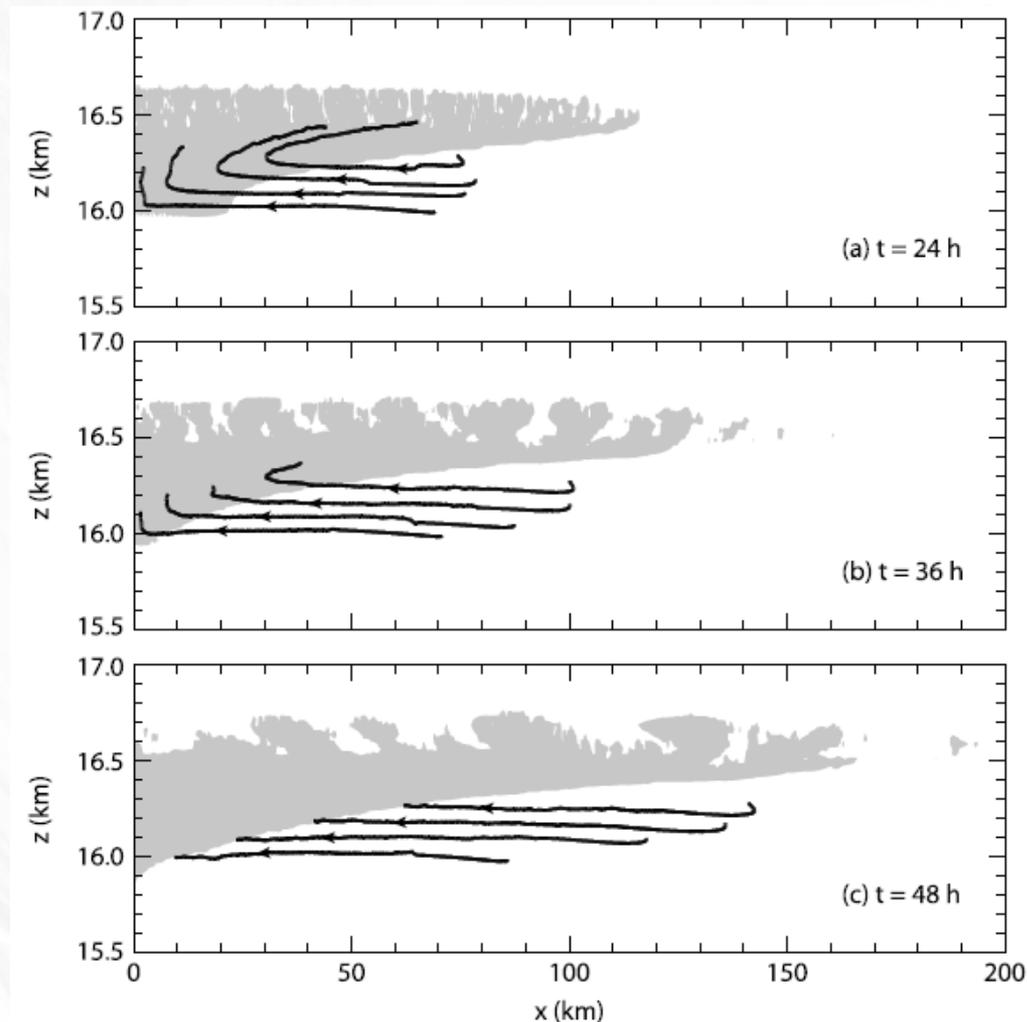


Hartmann, *GRL*, 2001



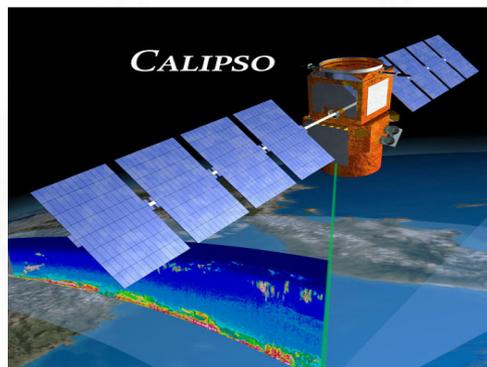
Cirrus Maintenance

- Cloud Induced Circulation
- Heating induces Cirrus growth
- Rising motion inside cloud and sinking outside

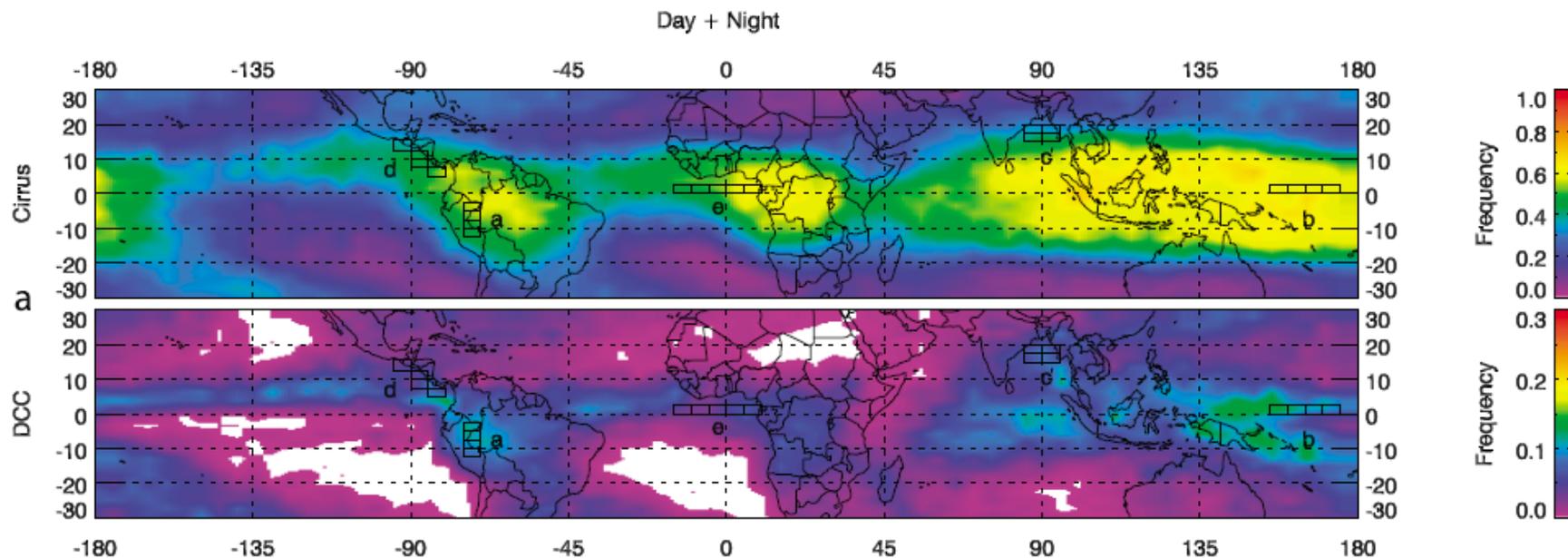


Dinh, *JGR*, 2010

CALIPSO Climatology

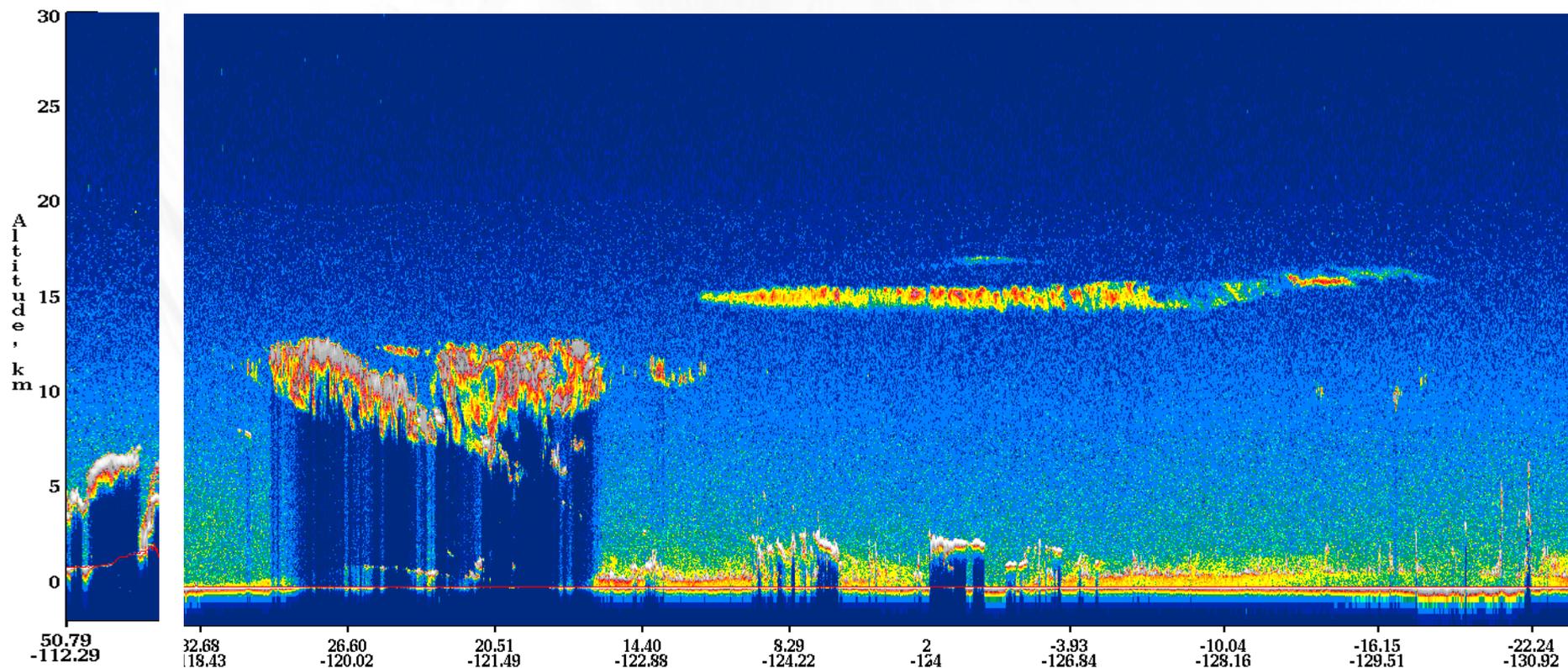


- Expect most cirrus in West Pacific
- Least activity in East Pacific



Sassen, *JGR*, 2009

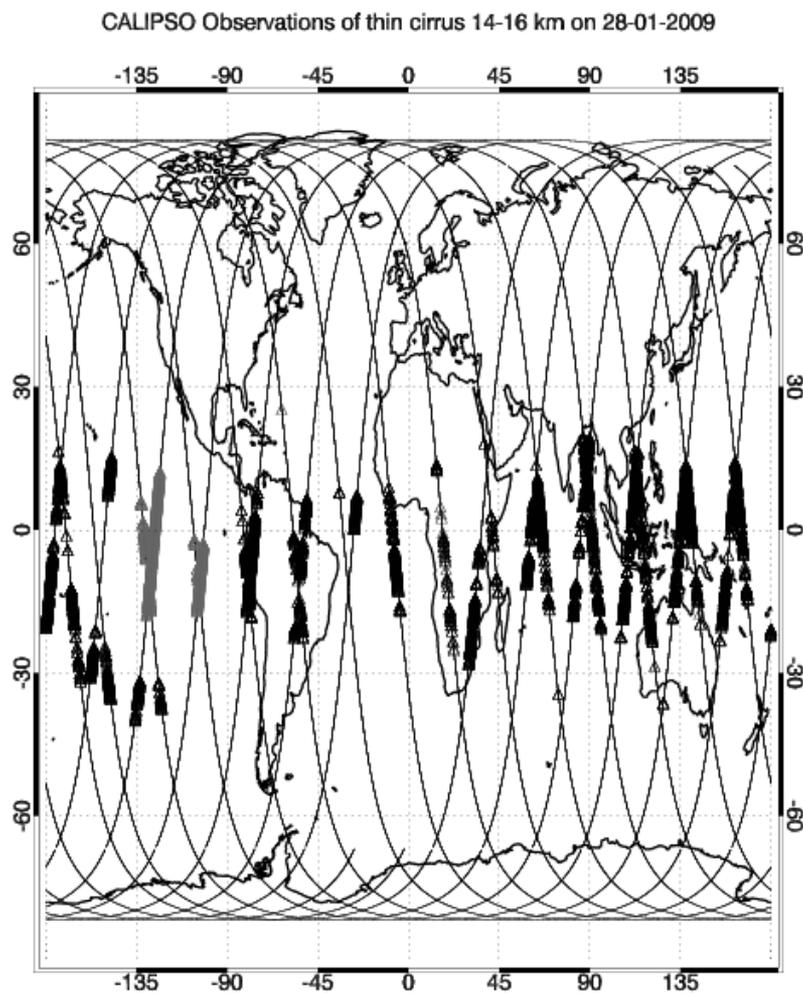
CALIPSO Case Study



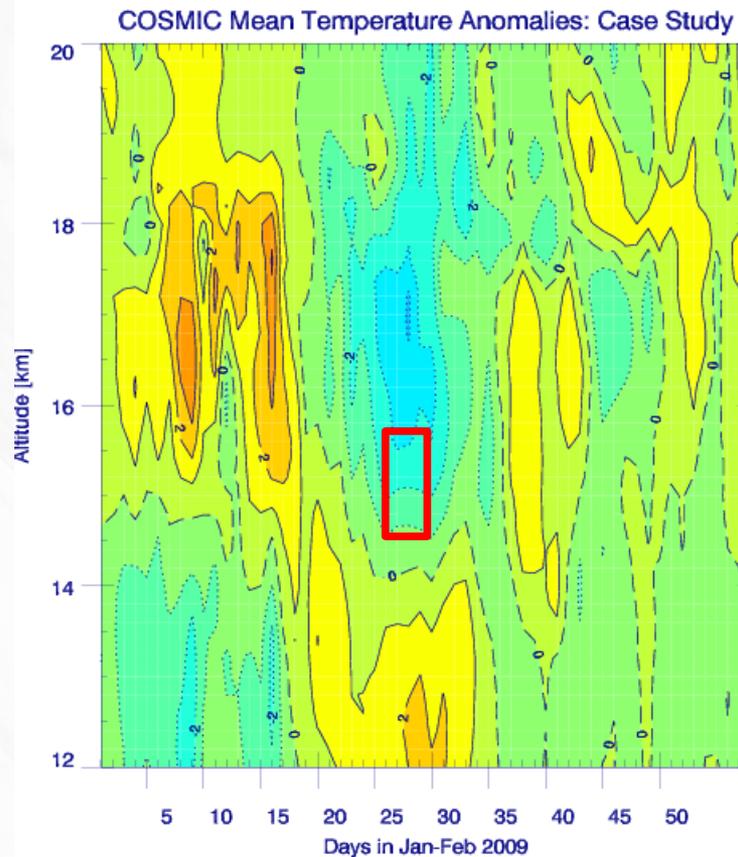
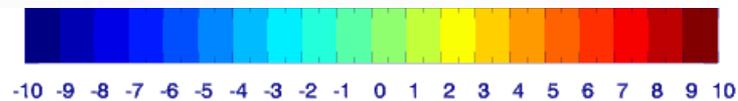
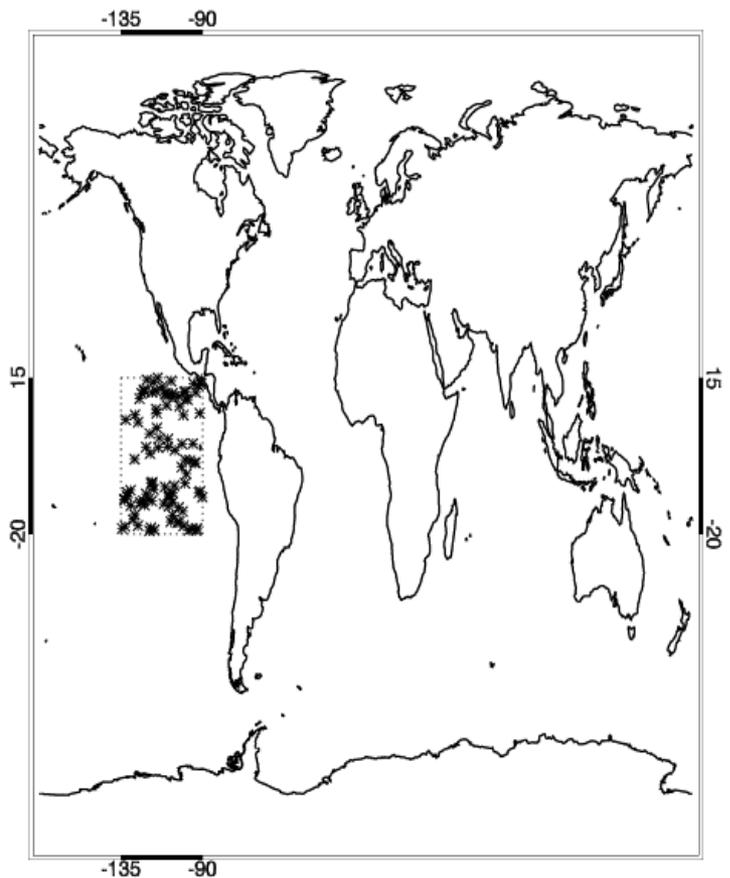
28 Jan 2009

COSMIC Coincidences

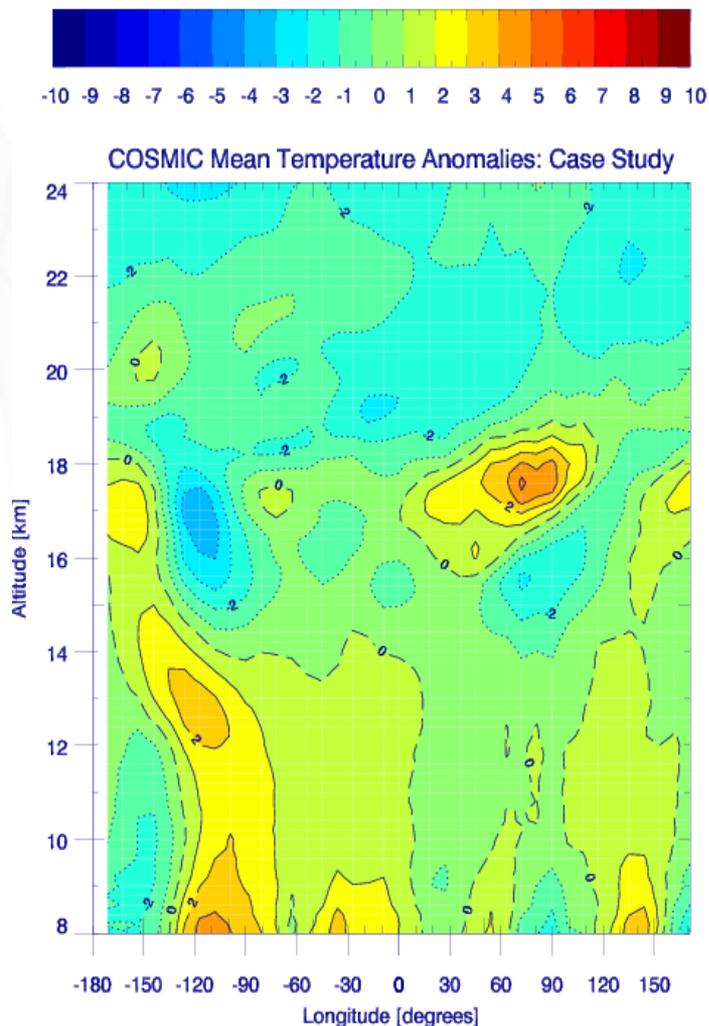
- Most thin cirrus accompanied by convection
- Eastern Pacific Case Study completely isolated from convection



COSMIC Cloud Coincidences

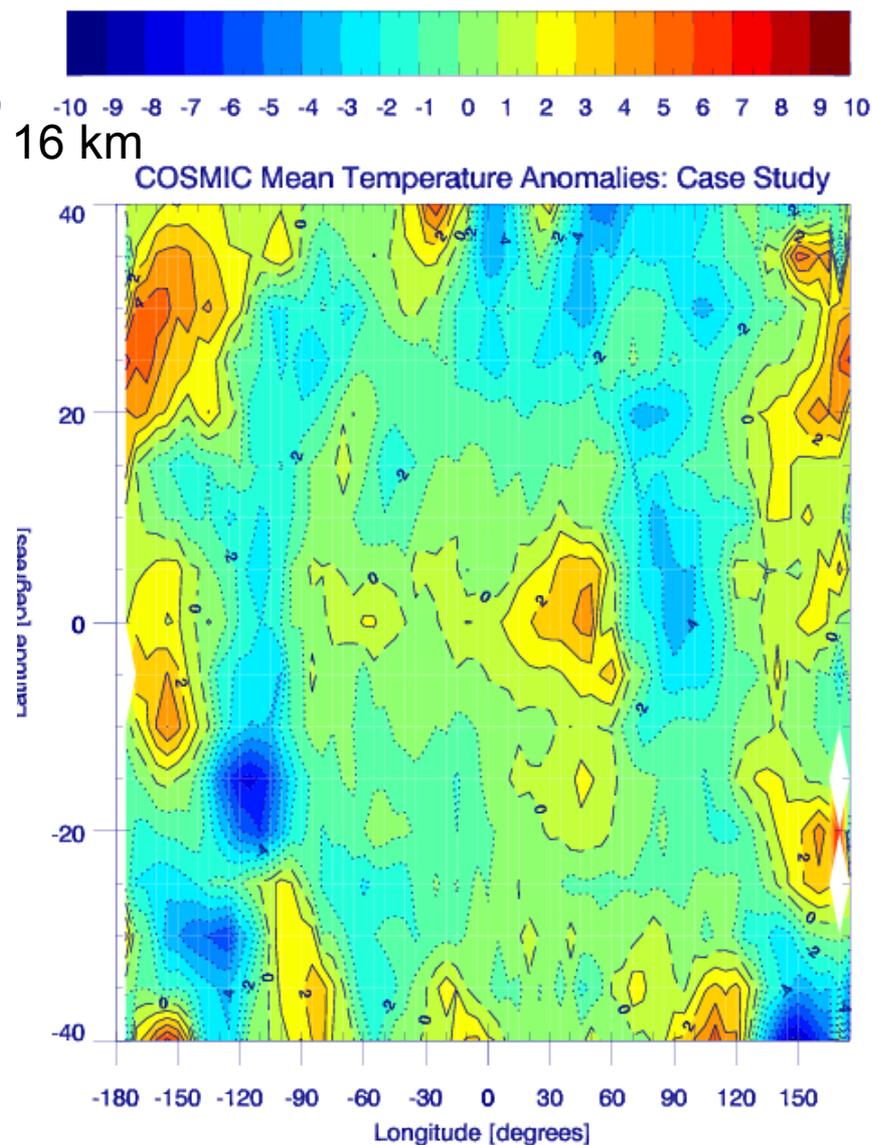
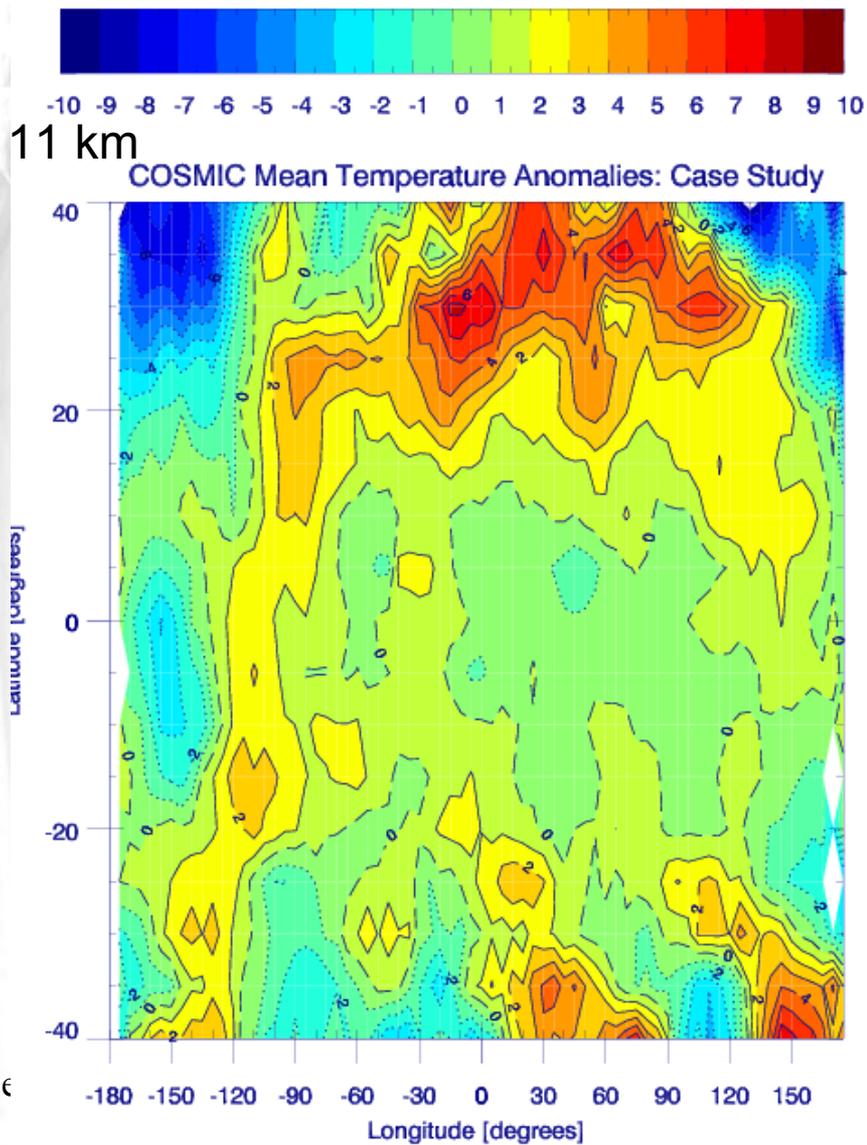


COSMIC Longitudinal Temperature



- Kelvin Wave present over Western Pacific
- No waves near Cold Anomaly
- Unexpected Balance between Anomalies in Eastern Pacific

COSMIC Horizontal Temperature



NCEP PV at 200 hPa

- Tropical PV Intrusion
- Midlatitude air

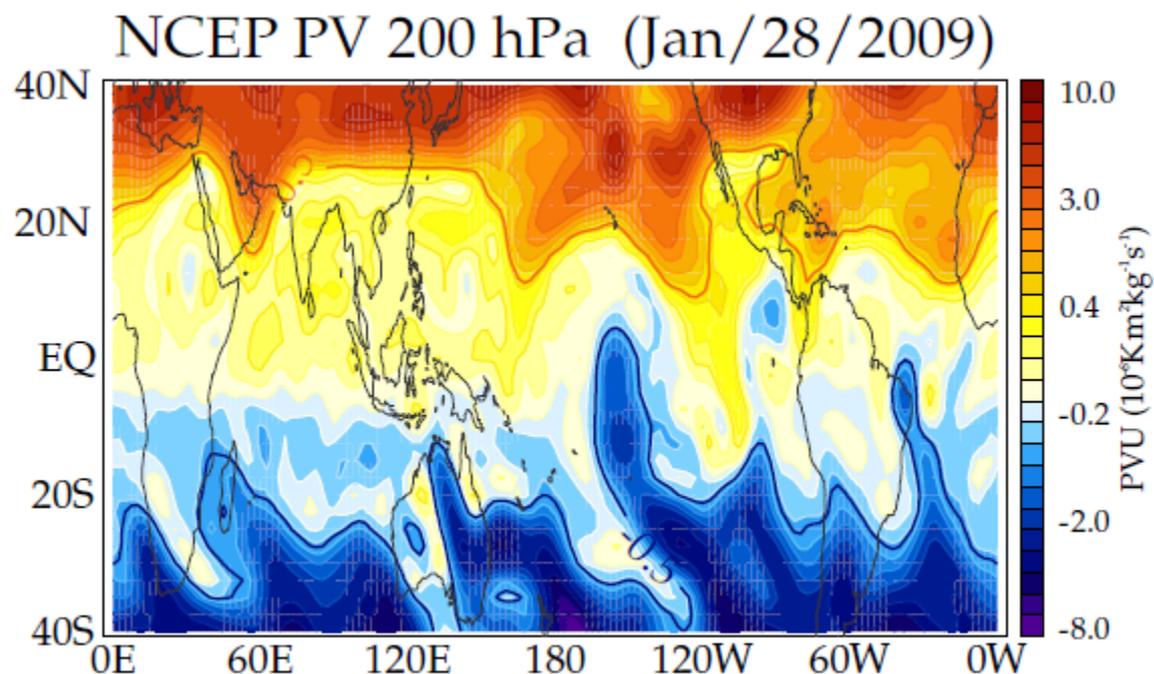


Figure Courtesy of M. Park

Summary

- Extensive, isolated cirrus cloud on 27-29 Jan 2009
- Cloud only lasts 2-3 days
- Cold anomaly persists over 5-6 days
- Appears to be caused by mid-latitude intrusion
- Induced heating not apparent
- Cloud top does not appear to be significant

- Cloud is formed under odd circumstances – perhaps this explains why observations differ from theory...?

The NESL Mission is:

**To advance understanding of weather, climate, atmospheric composition and processes;
 To provide facility support to the wider community; and,
 To apply the results to benefit society.**