Cloud-Induced Uncertainties in AIRS Temperature and Water Vapor Sounding Retrievals

Sun Wong, Eric Fetzer, Mathias Schreier, Gerald Manipon, Brian Wilson, Qing Yue

Jet Propulsion Laboratory, California Institute of Technology

AIRS Science Team Meeting (May 2013)

©2013 California Institute of Technology.
Government Sponsorship Acknowledged: NASA AIRS and ESDR Projects

- How do AIRS T and q retrieval uncertainties depend on cloud states?

- How do the changes of AIRS T and q retrievals from their 1st Guess depend on cloud states

AIRS-MODIS-IGRA Match-ups

- AIRS V5 Sup. T against IGRA T, and AIRS V5 Sup. q against IGRA q
  IGRA: Integrated Global Radiosonde Archive

- Cloud States: Cloud Top Pressure-Cloud Optical Depth (MOIDS c5)

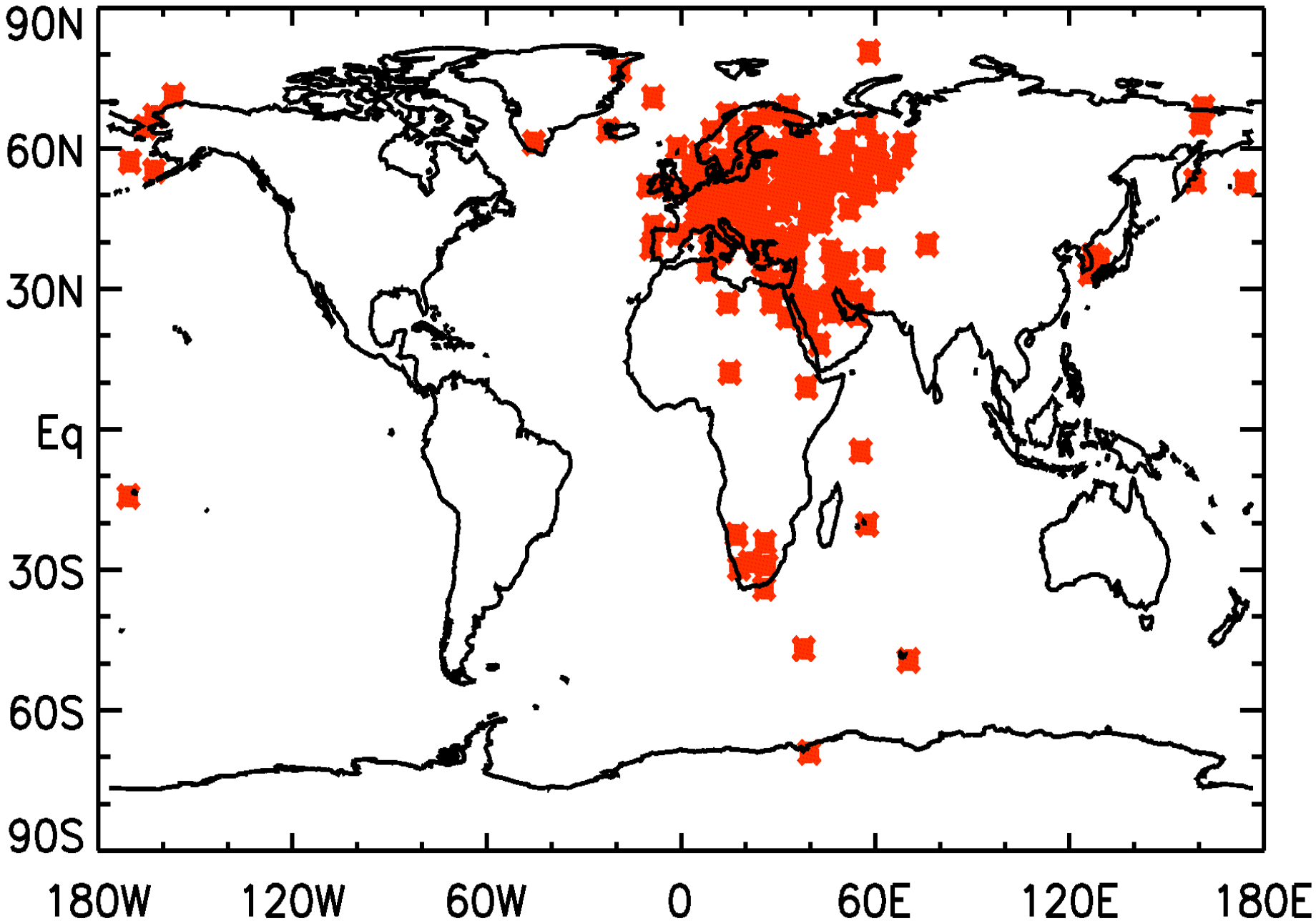
- 2007-2010 June-July-August and December-January-February

- Using all sondes' match ups

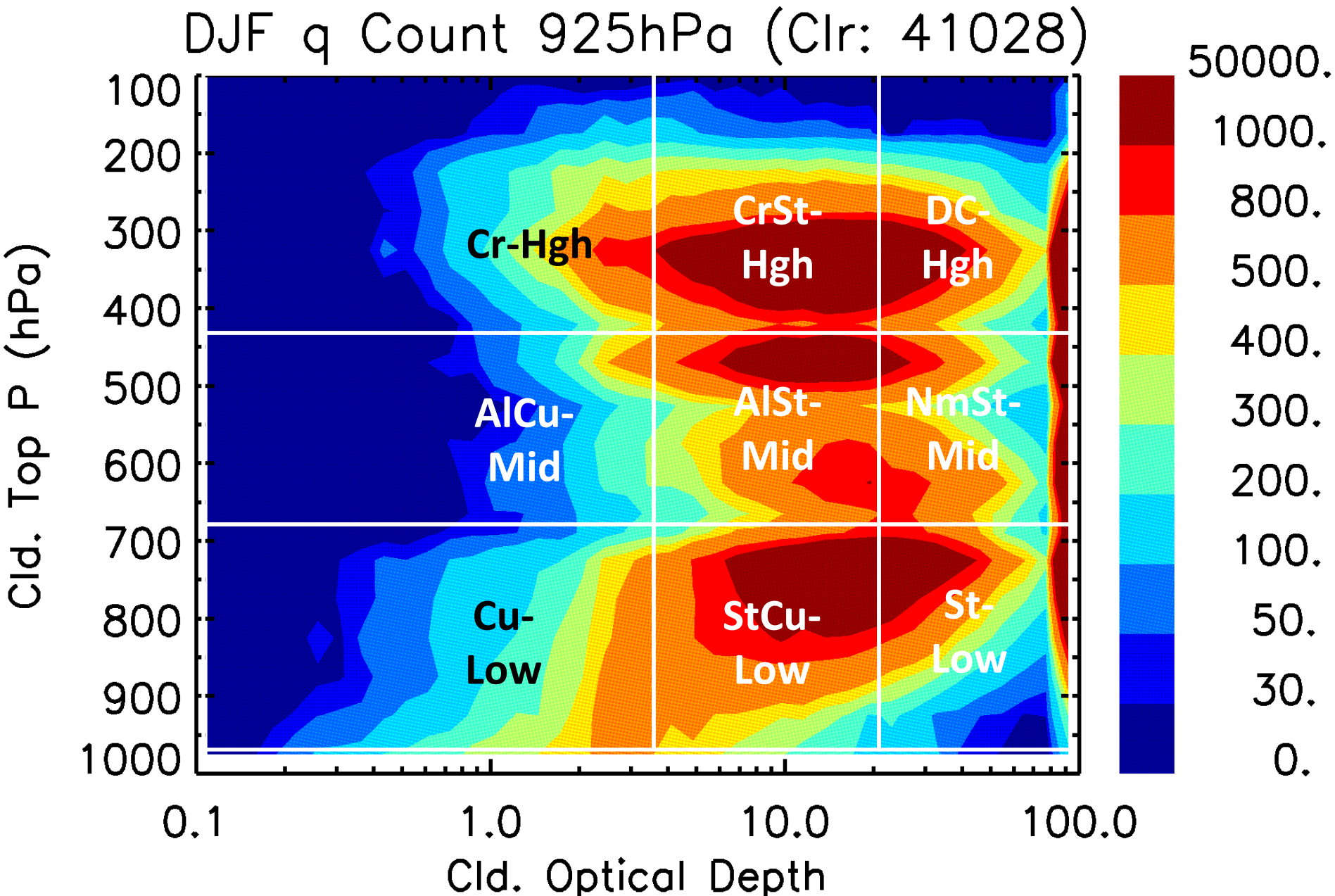
- Assuming T and q fields are uniform in an AMSU footprint, all MODIS footprints in an AMSU footprint share the same T and q profiles

- We examine profiles with no quality control, P<PGood, and P<PBest

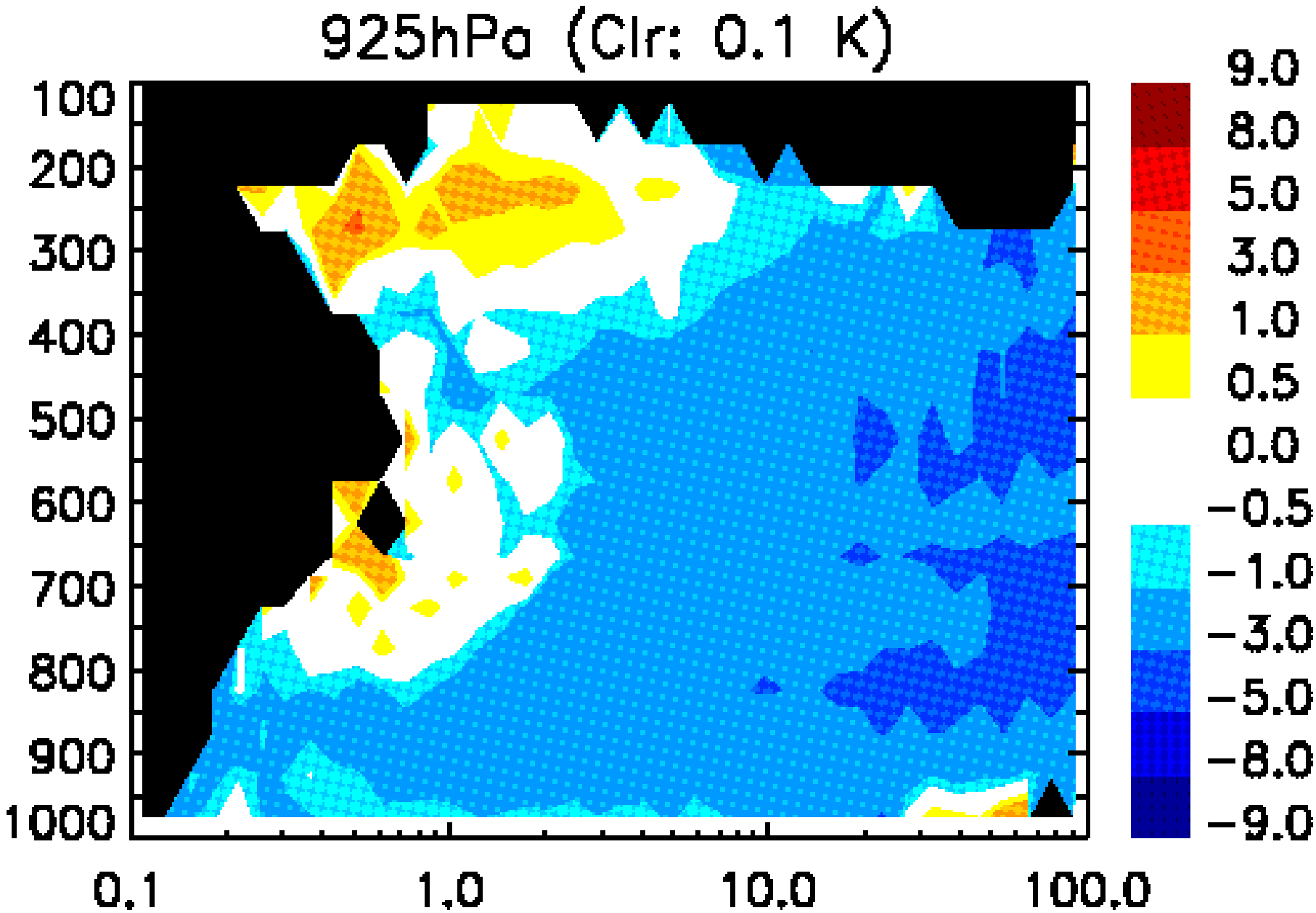
IGRA Sonde Sites



Counts of No Qual on Cloud-State Space



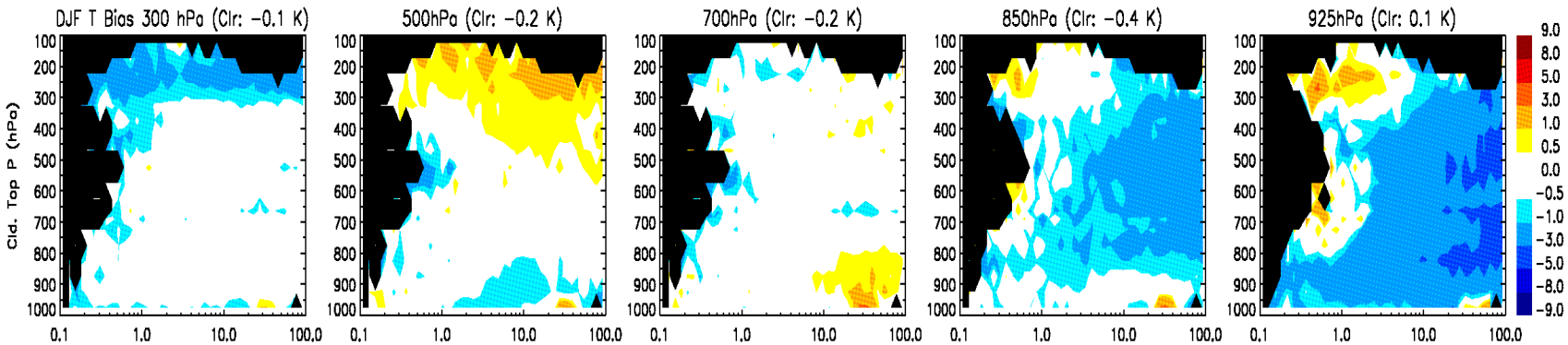
DJF T Bias (P<PGood)



DJF T Yield, Bias and 1st Guess (P<PGood)

300 hPa 500 hPa 700 hPa 850 hPa 925 hPa

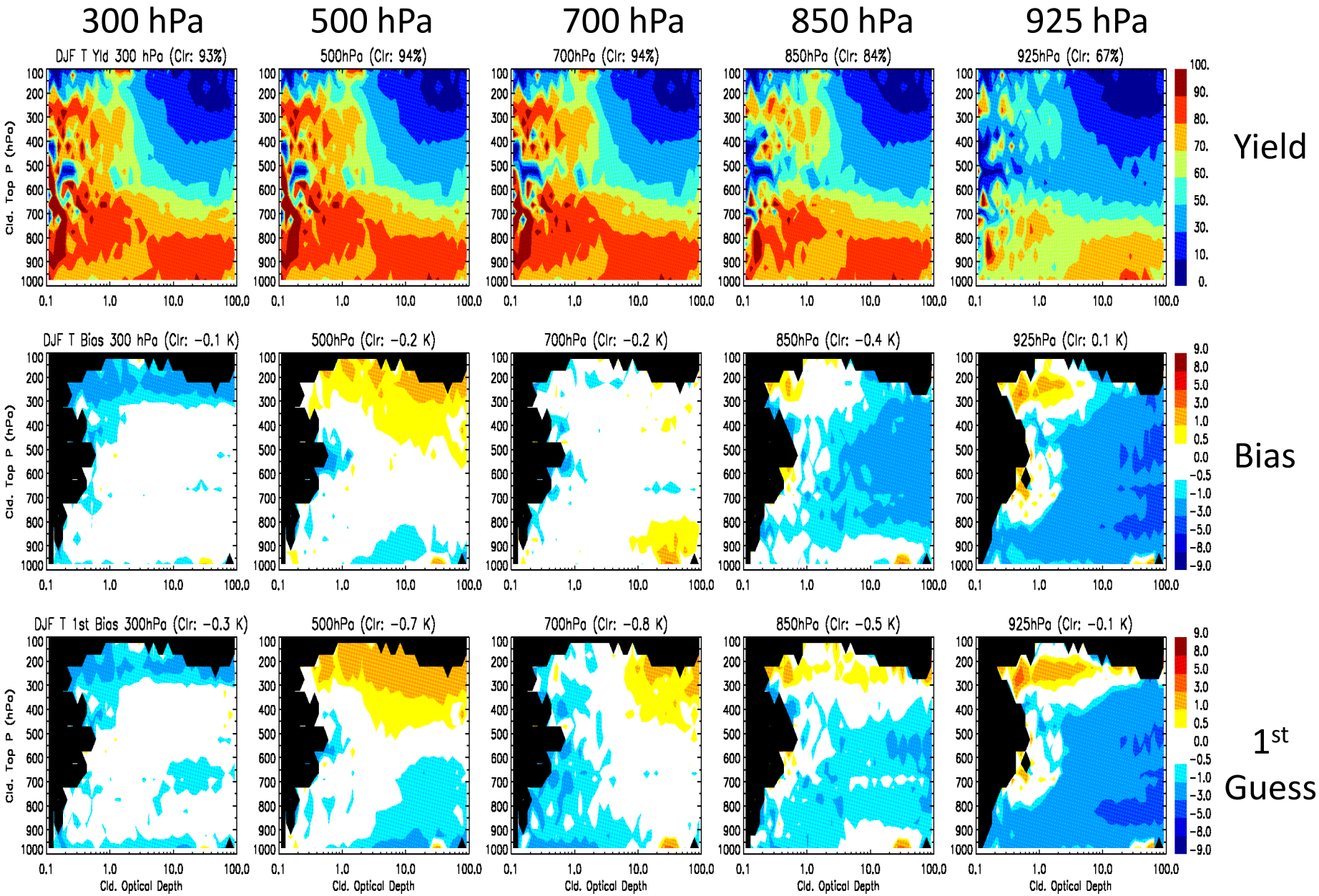
Yield



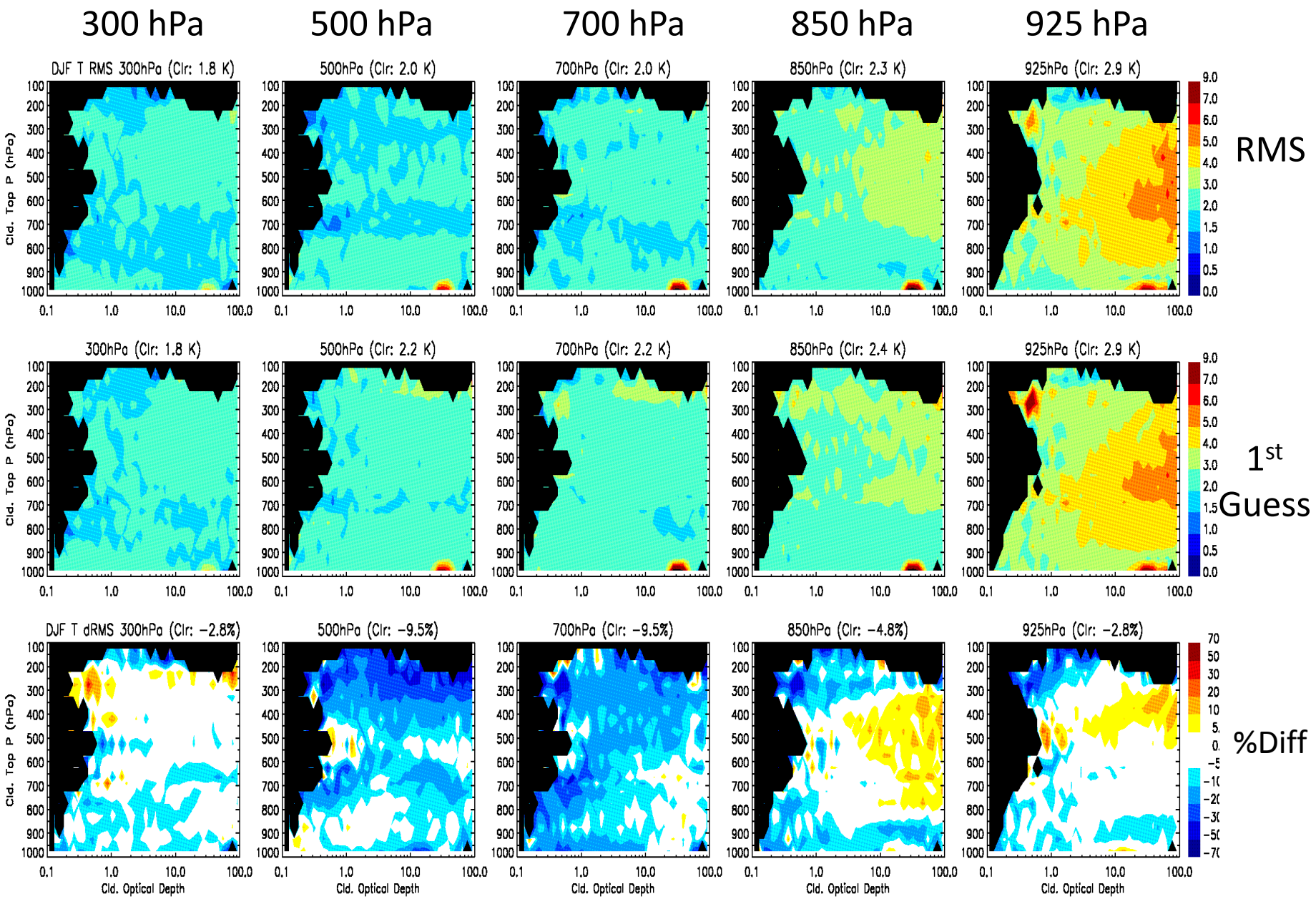
Bias

1st Guess

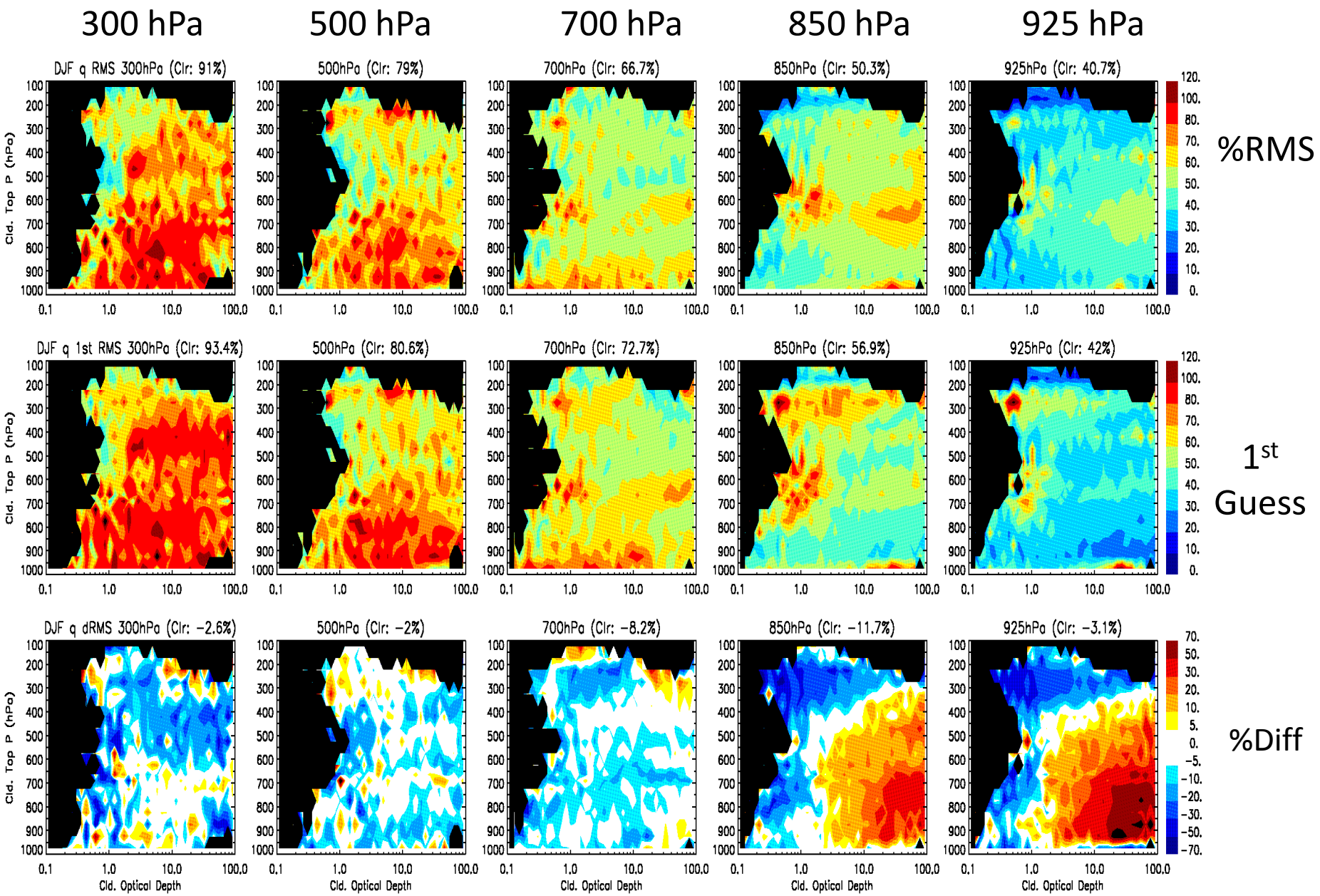
DJF T Yield, Bias and 1st Guess (P<PGood)



DJF T RMS, 1st Guess, %Difference (P<PGood)



DJF q %RMS, 1st Guess, %Difference (P<PGood)



Preliminary Conclusions:

- For T at lower troposphere, moderate to thick clouds result in cold bias, while high thin clouds result in warm and low thin clouds result in cold biases

- High clouds result in T biases in the upper-middle troposphere, with the sign depending on altitudes

- For q at lower-middle troposphere, moderate to thick clouds result in dry biases. Thin clouds may cause wet biases in the lower troposphere in winter.

Validation of AIRS V5, V6, and ECMWF Water Vapor Against Dedicated Sondes

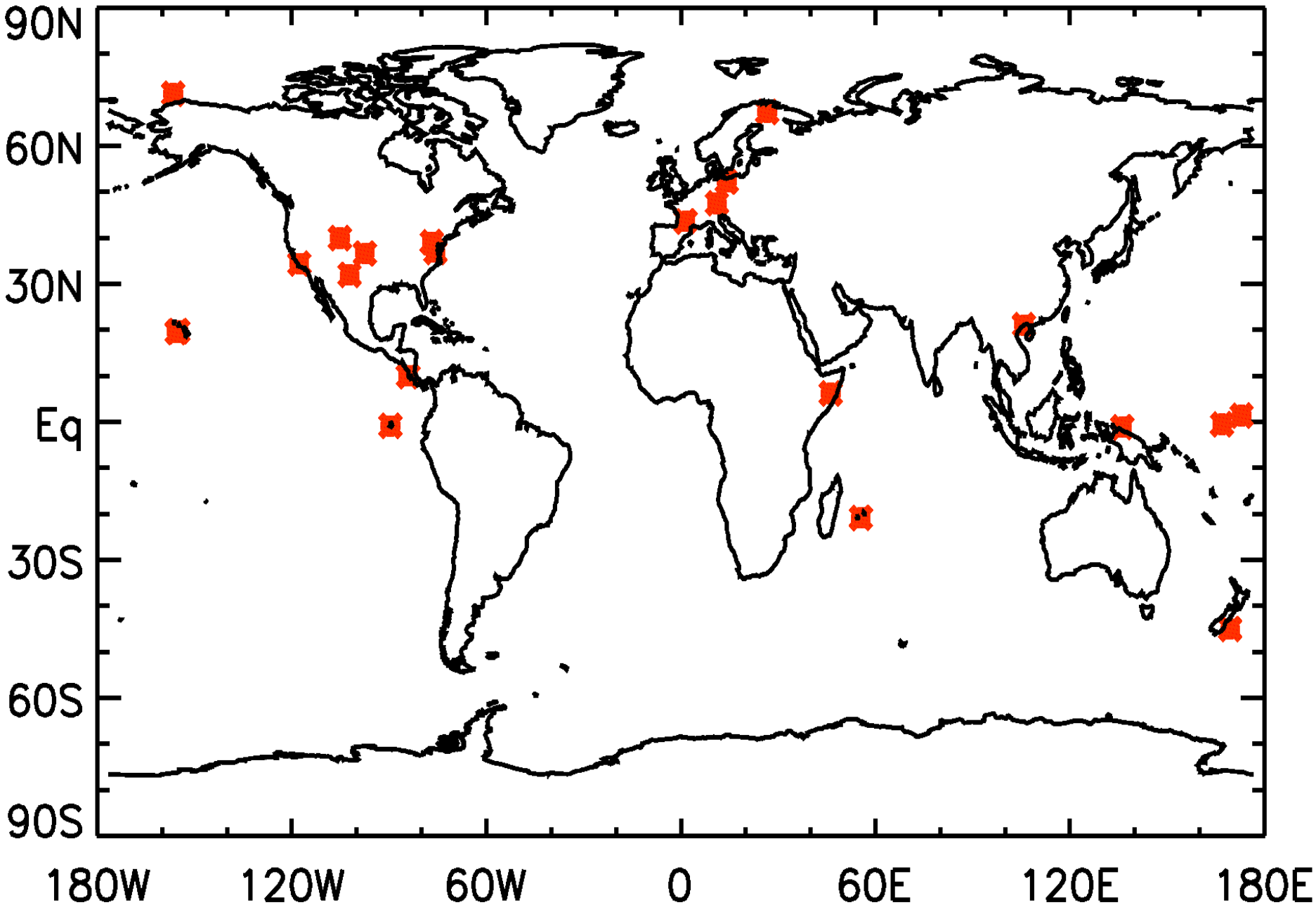
Sun Wong, Evan Manning, Evan Fishbein, Van Dang, and Eric Fetzer

Jet Propulsion Laboratory, California Institute of Technology

AIRS Science Team Meeting (May 2013)

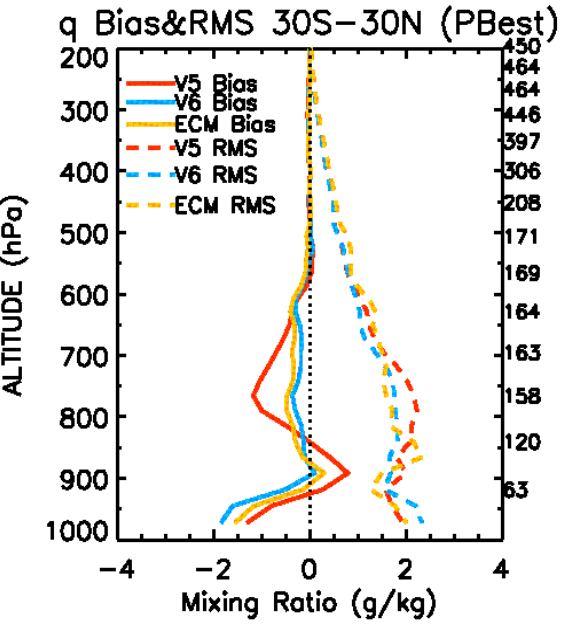
©2013 California Institute of Technology.
Government Sponsorship Acknowledged: NASA AIRS Project

Dedicated Sonde Sites

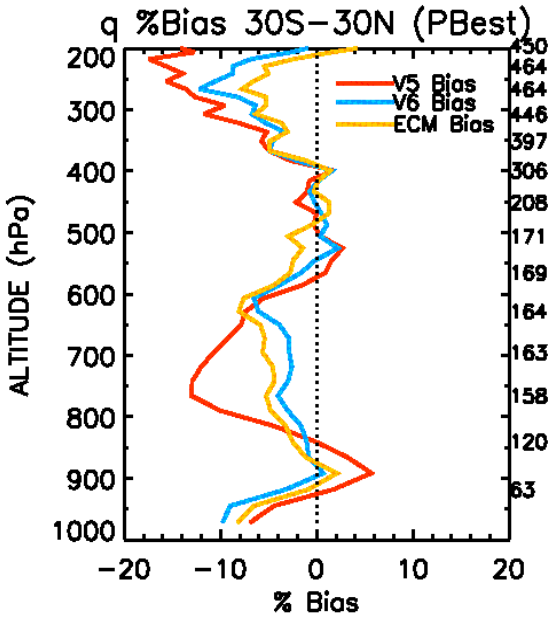


AIRS V5, V6, and ECMWF q Uncertainties (30°S-30°N)

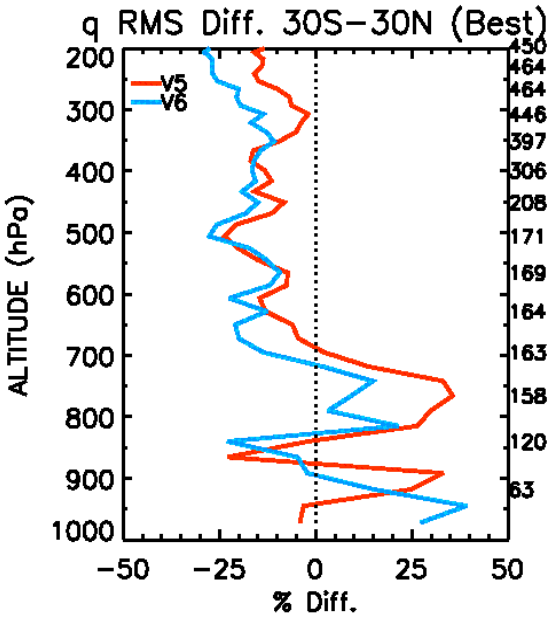
Bias and RMS



(Ret –Truth)*100./Truth



[RMS(Ret)–RMS(ECM)]*100./RMS(ECM)



Qual=0

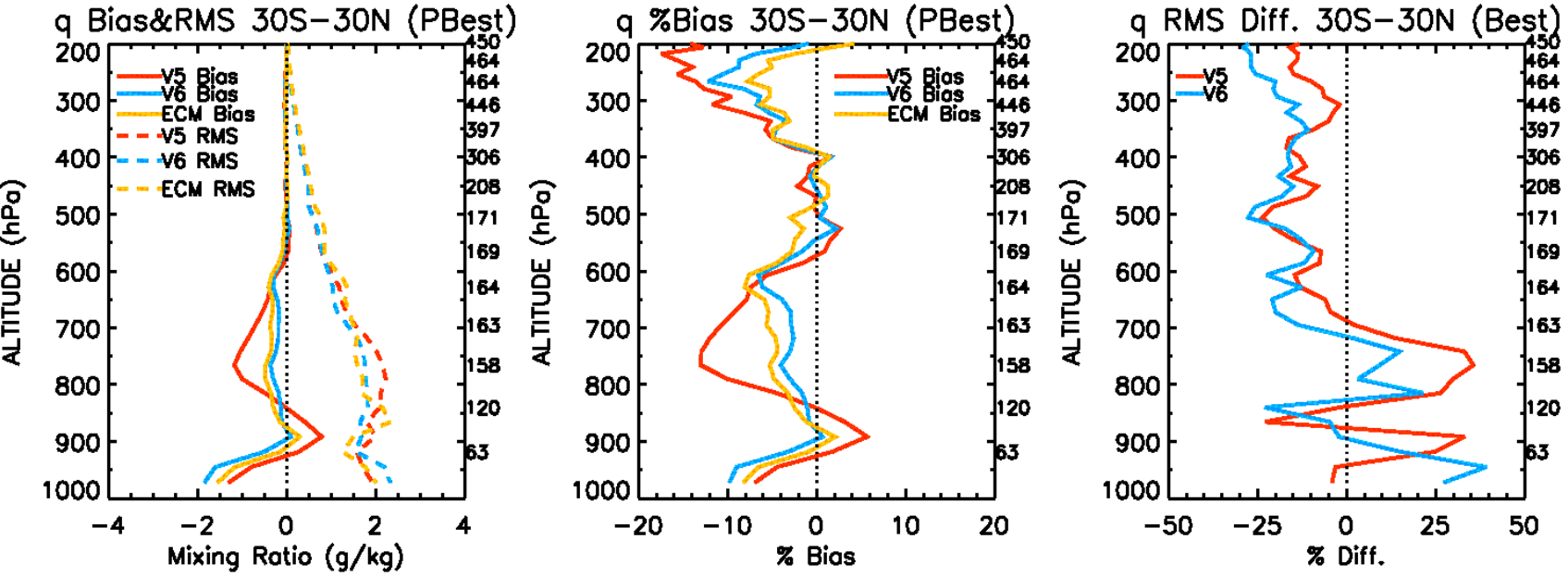
Qual<=1

AIRS V5, V6, and ECMWF q Uncertainties (30°S-30°N)

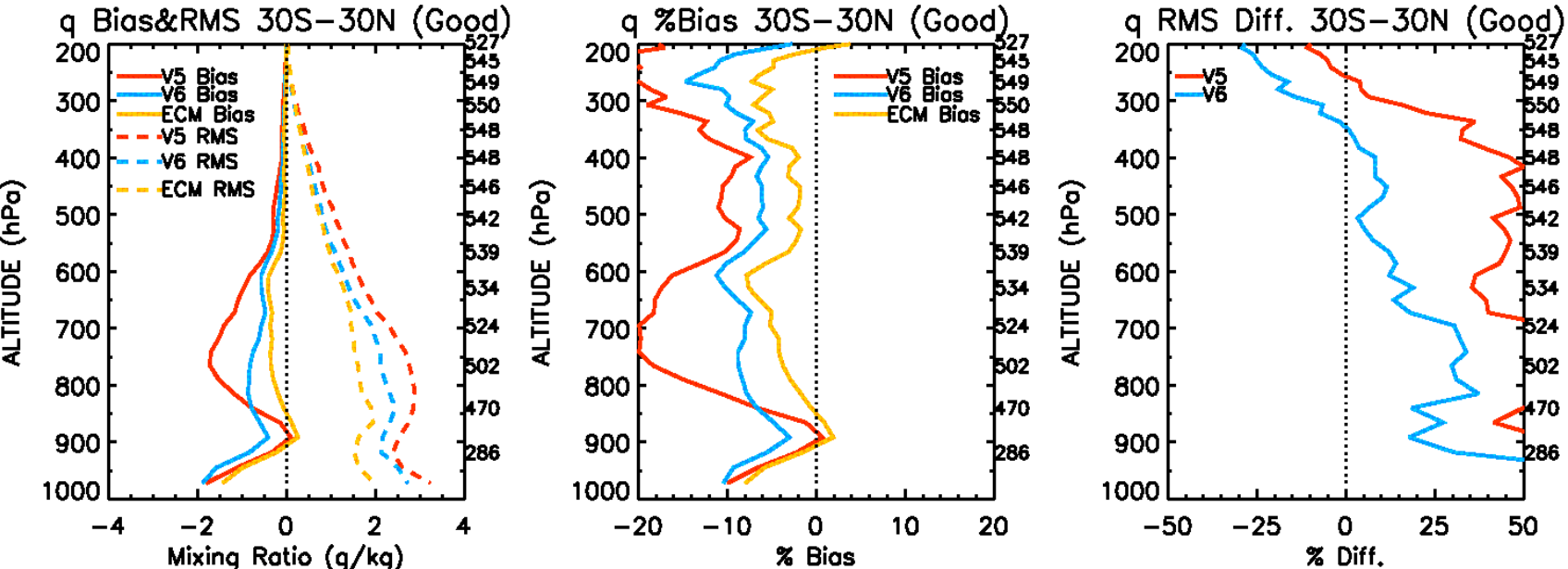
Bias and RMS

(Ret –Truth)*100./Truth

[RMS(Ret)–RMS(ECM)]*100./RMS(ECM)



Qual=0

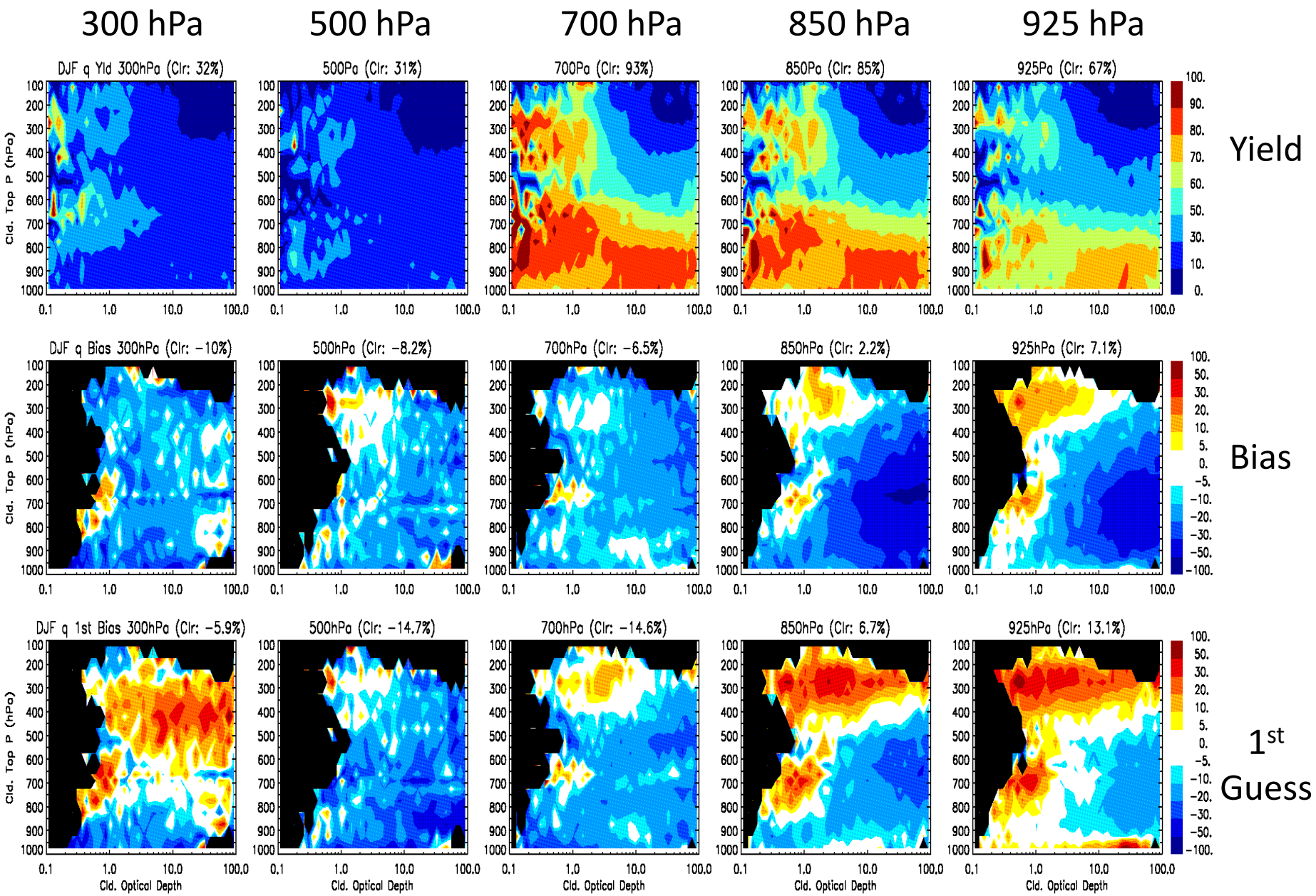


Qual<=1

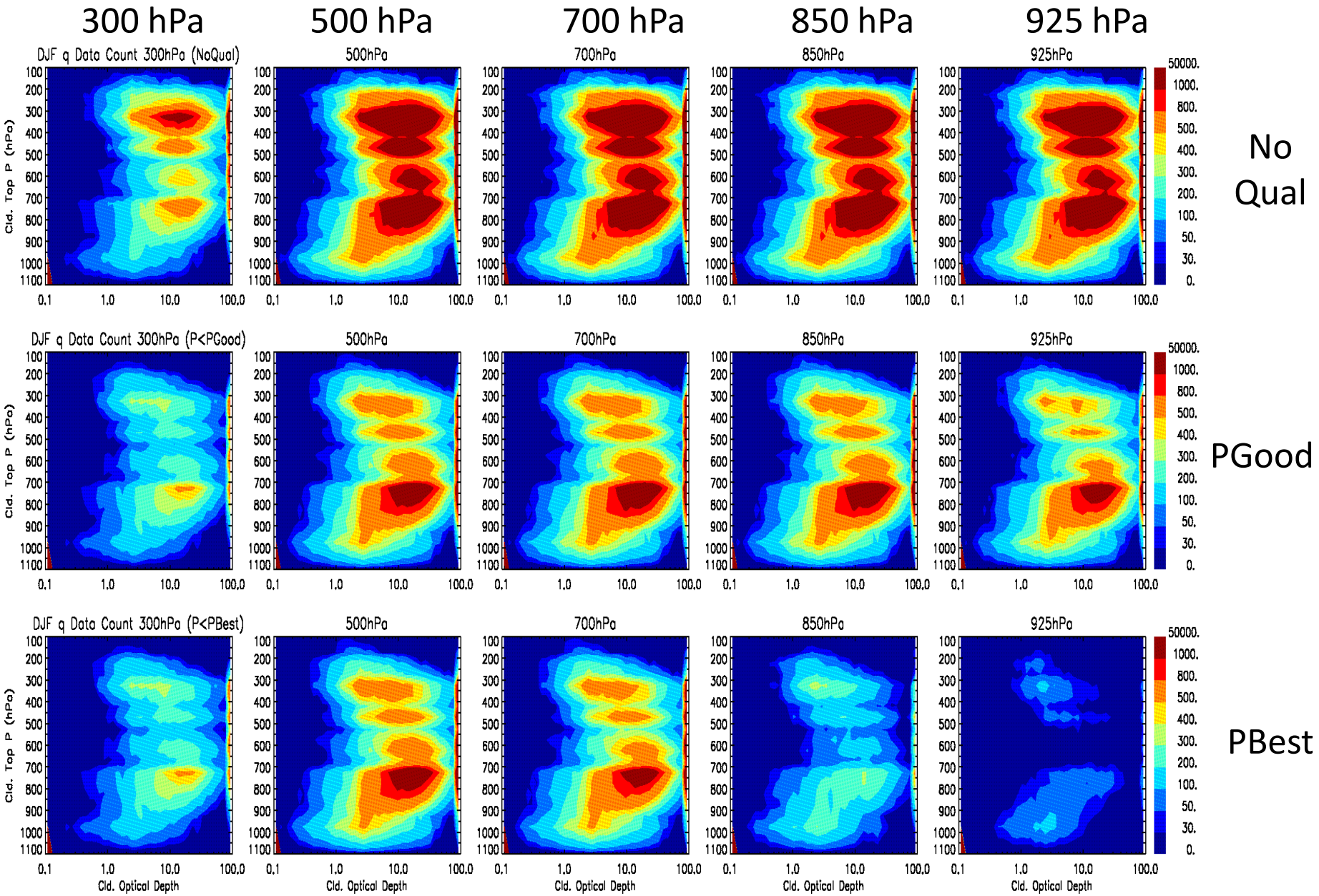
Conclusions:

- Above ~700 hPa, AIRS V6 q retrievals have smaller RMS errors than ECMWF's when best quality is chosen

DJF q Yield, %Bias and 1st Guess (P<PGood)



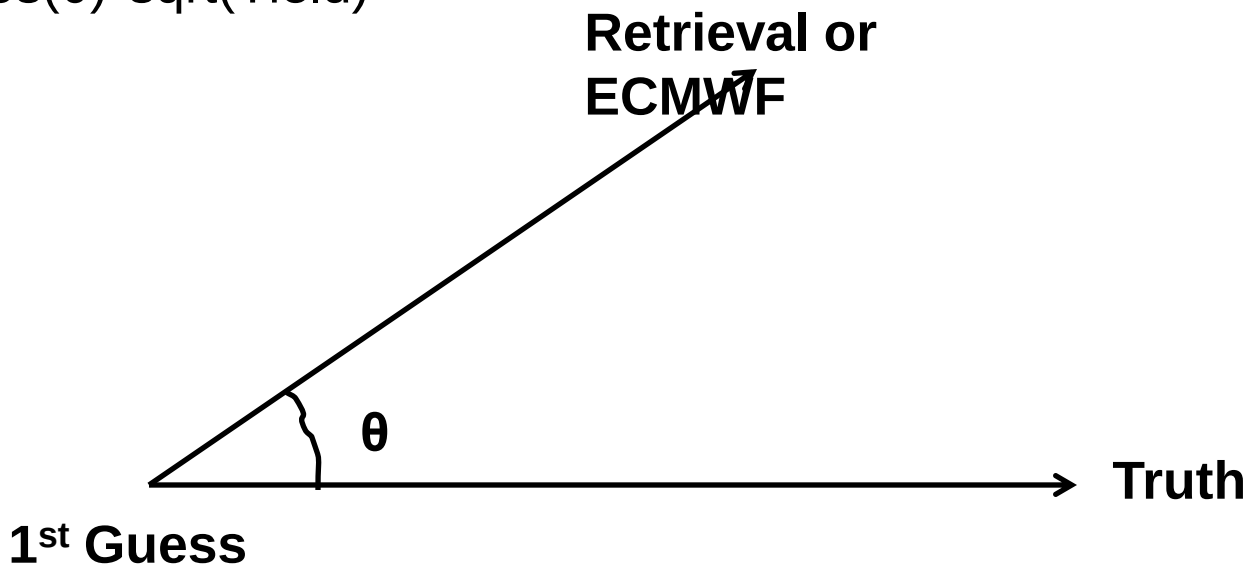
DJF Data Counts for q (2007-2009)



- Skill = Corr(retrieval−1st Guess, truth−1st Guess)*sqrt(Yield)

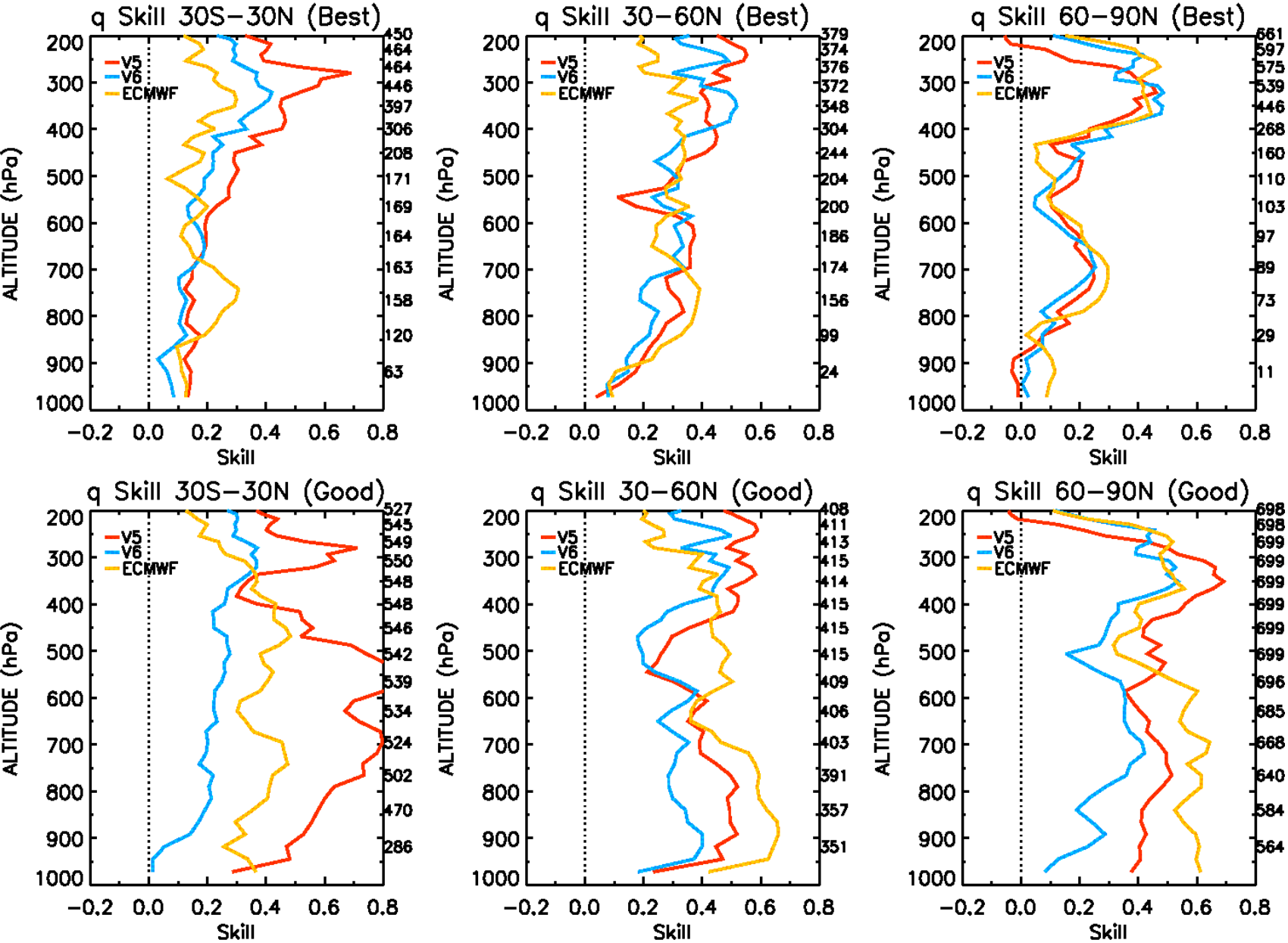
- If retrieval ~forecast, skill = 0
- If retrieval~truth (i.e., rabos), skill = 1

Skill = cos(θ)*sqrt(Yield)



AIRS V5, V6, and ECMWF q Skills from 1st Guess

30°S-30°N | 30°-60°N | 60°-90°N



Qual=0

Qual<=1