Cloud-Dependent Uncertainties in AIRS V6 and ECMWF Temperature and Specific Humidity

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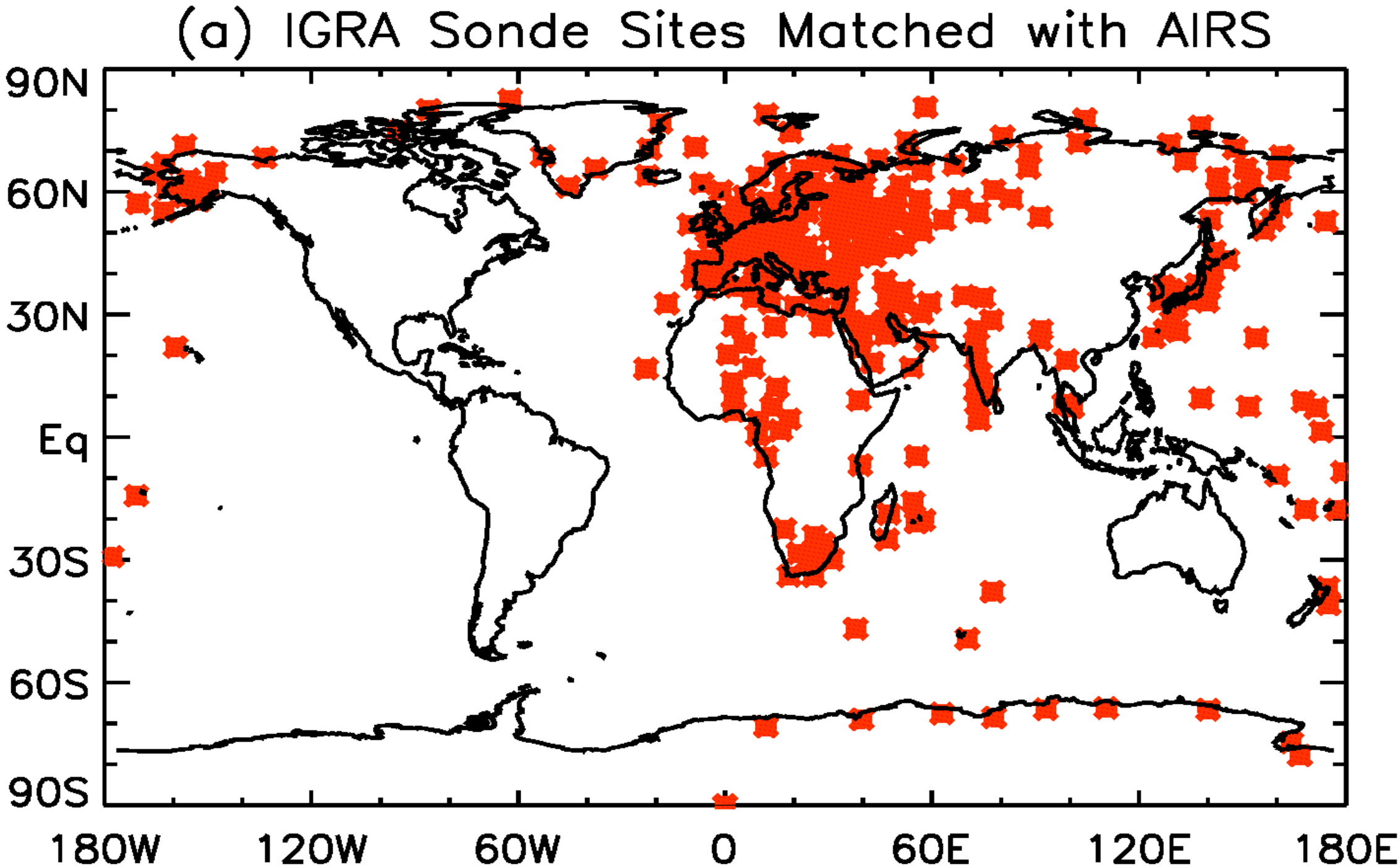
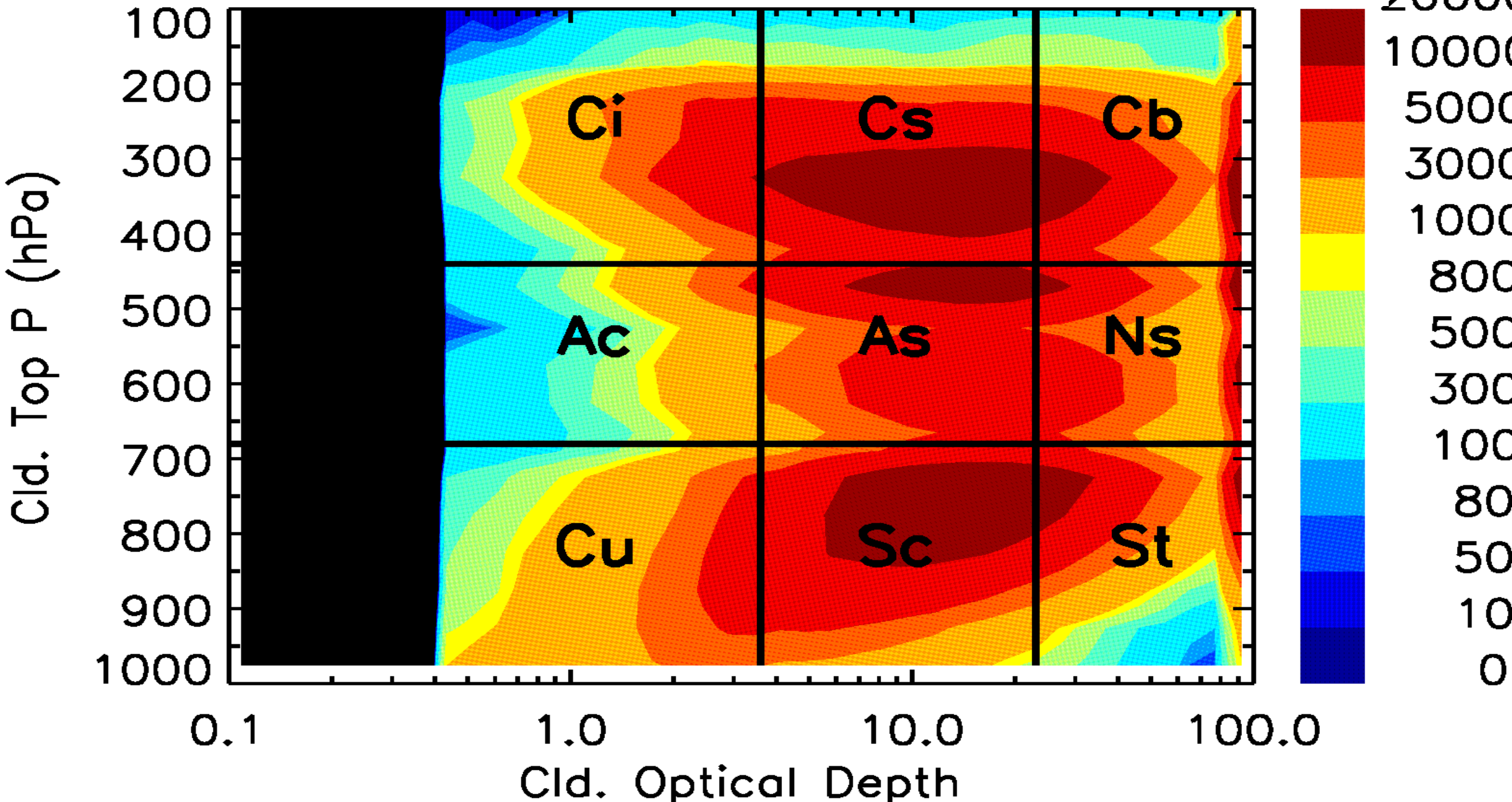
Goals:

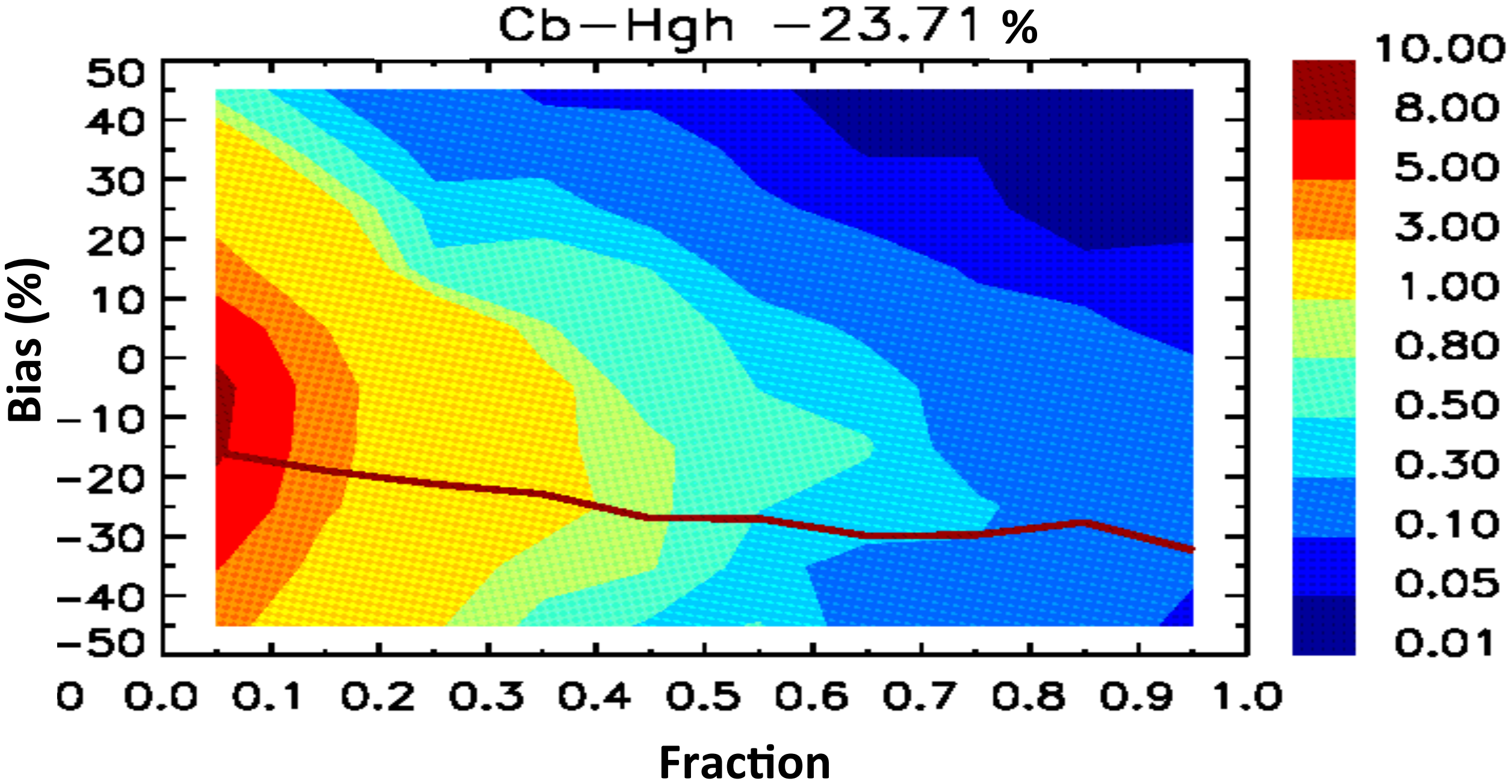
- Validate AIRS V6 L2 T and q retrievals and their reported errors with IGRA and Dedicated radiosonde measurements
- Identify how the uncertainties depend on cloud states (MODIS: Cloud top pressure, CTP, and Cloud optical depth, COD)
- Compare the uncertainties with those of 1st Guess (Neural Network)
- Compare the uncertainties with those of ECMWF


(a) IGRA Sonde Sites Matched with AIRS
90N
60N
30N
Eq
30S
60S
90S
180W
120W
60W
0
60E
120E
180E

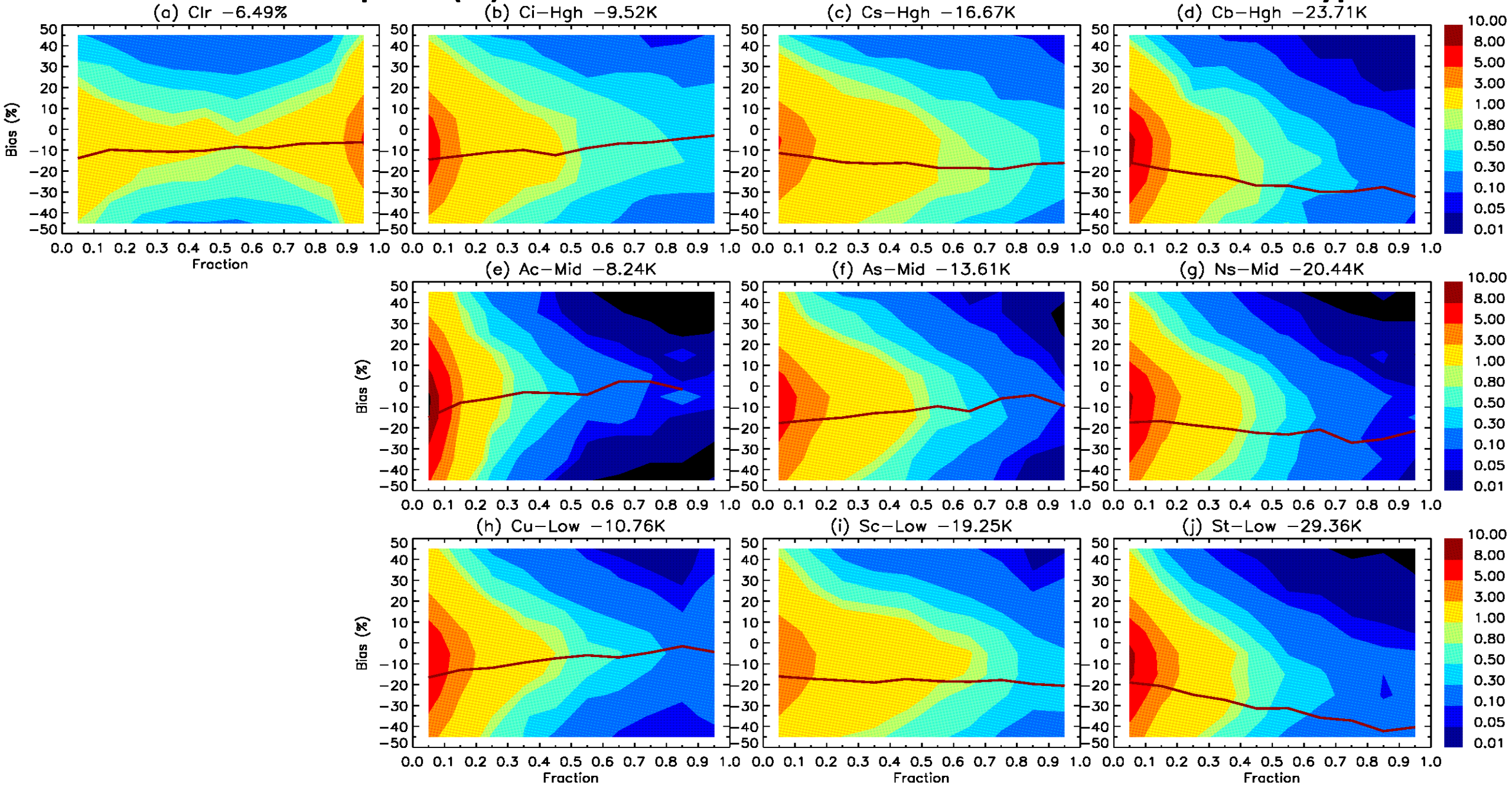
2007-2009 MODIS Sample Histogram and Cloud Types



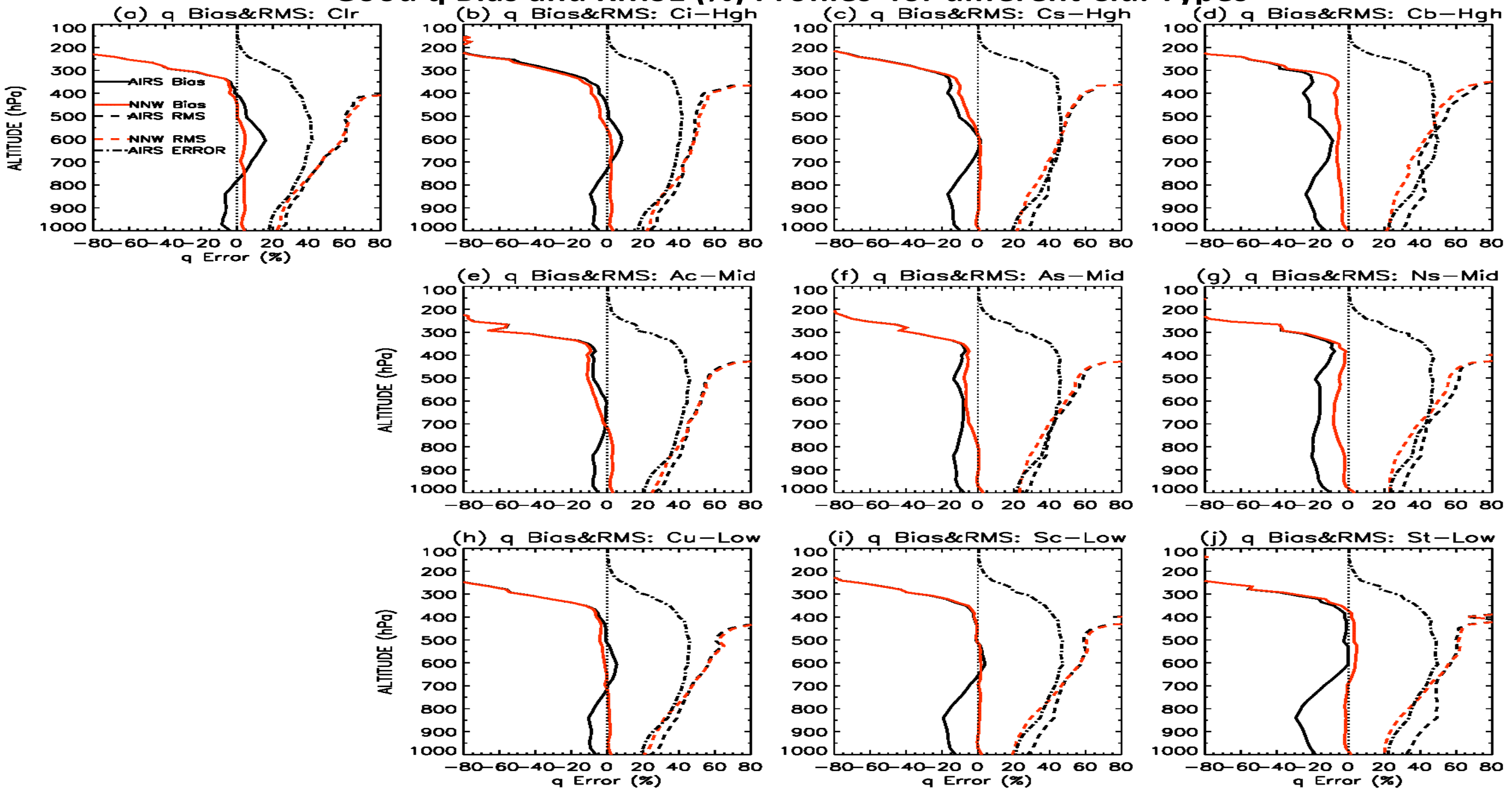
850 hPa Good q Bias (%) PDF as a Function of Cb Cloud Fraction



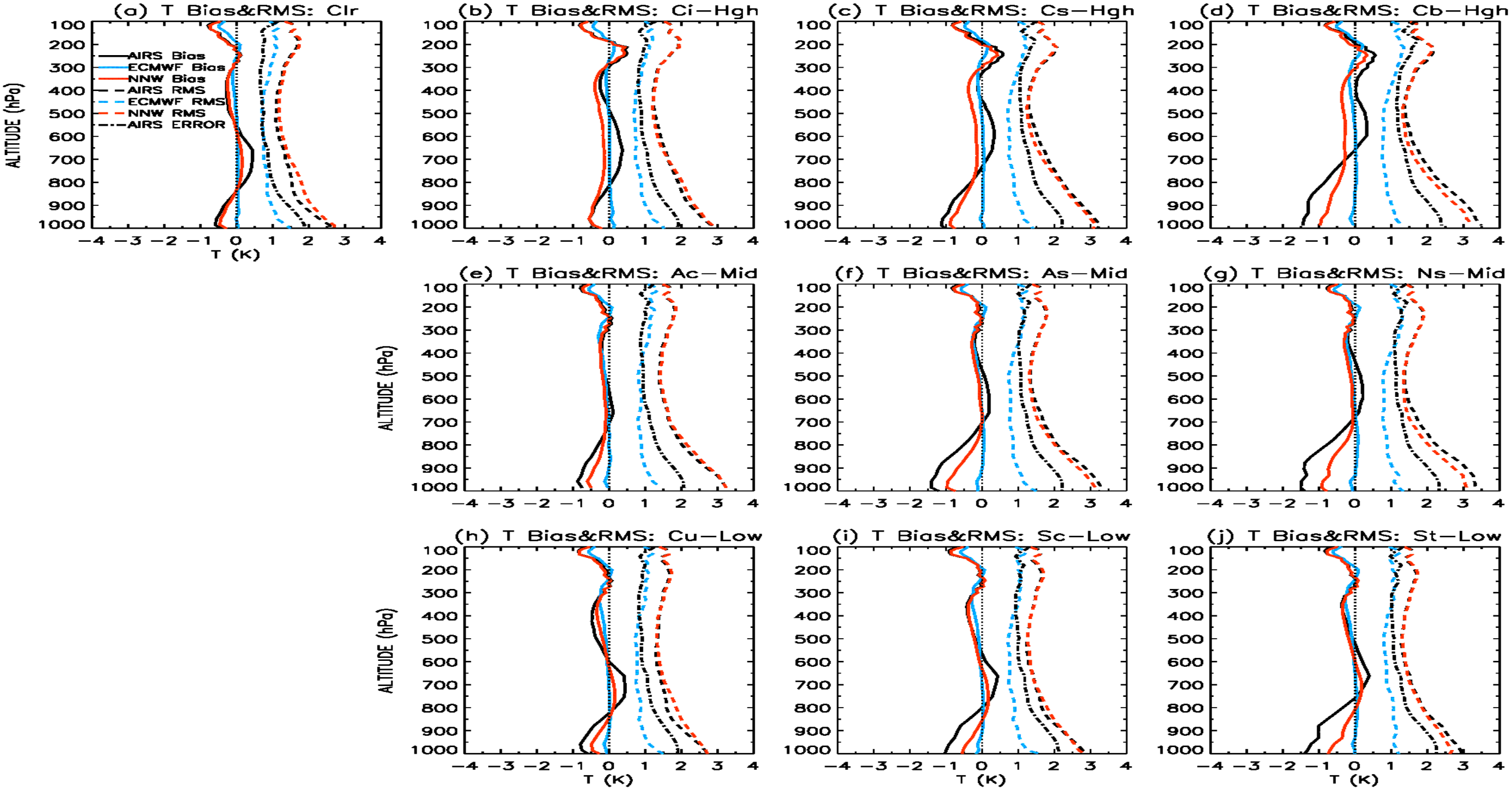
850 hPa Good q Bias (%) PDF as a Function of Cld. Fractions of different Cld Types



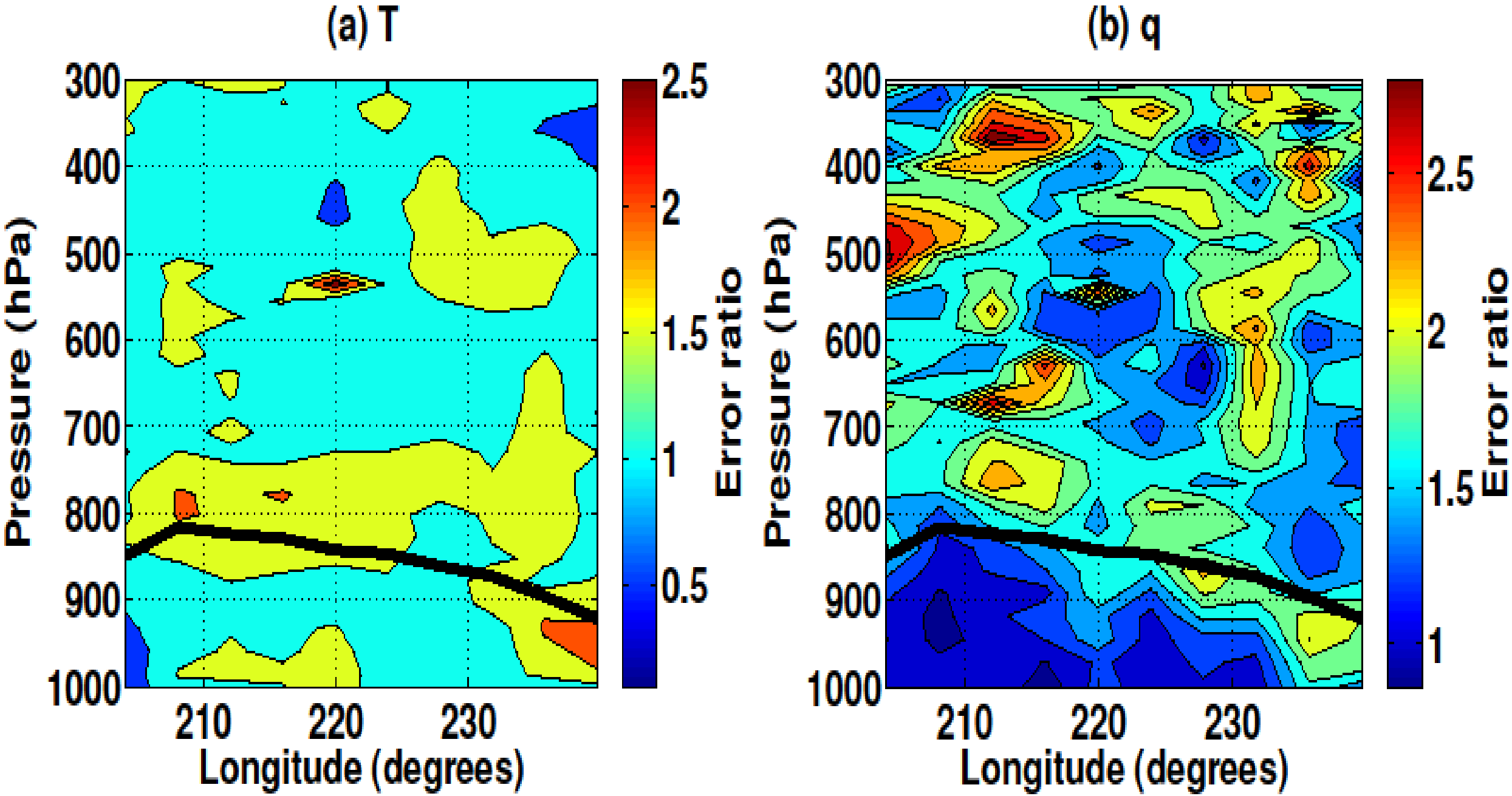
Good q Bias and RMSE (%) Profiles for different Cld. Types



Good T Bias and RMSE (K) Profiles for different Cld. Types



RMSE against MAGIC/V6 Errors Product (Courtesy of Peter Kalmus, JPL)



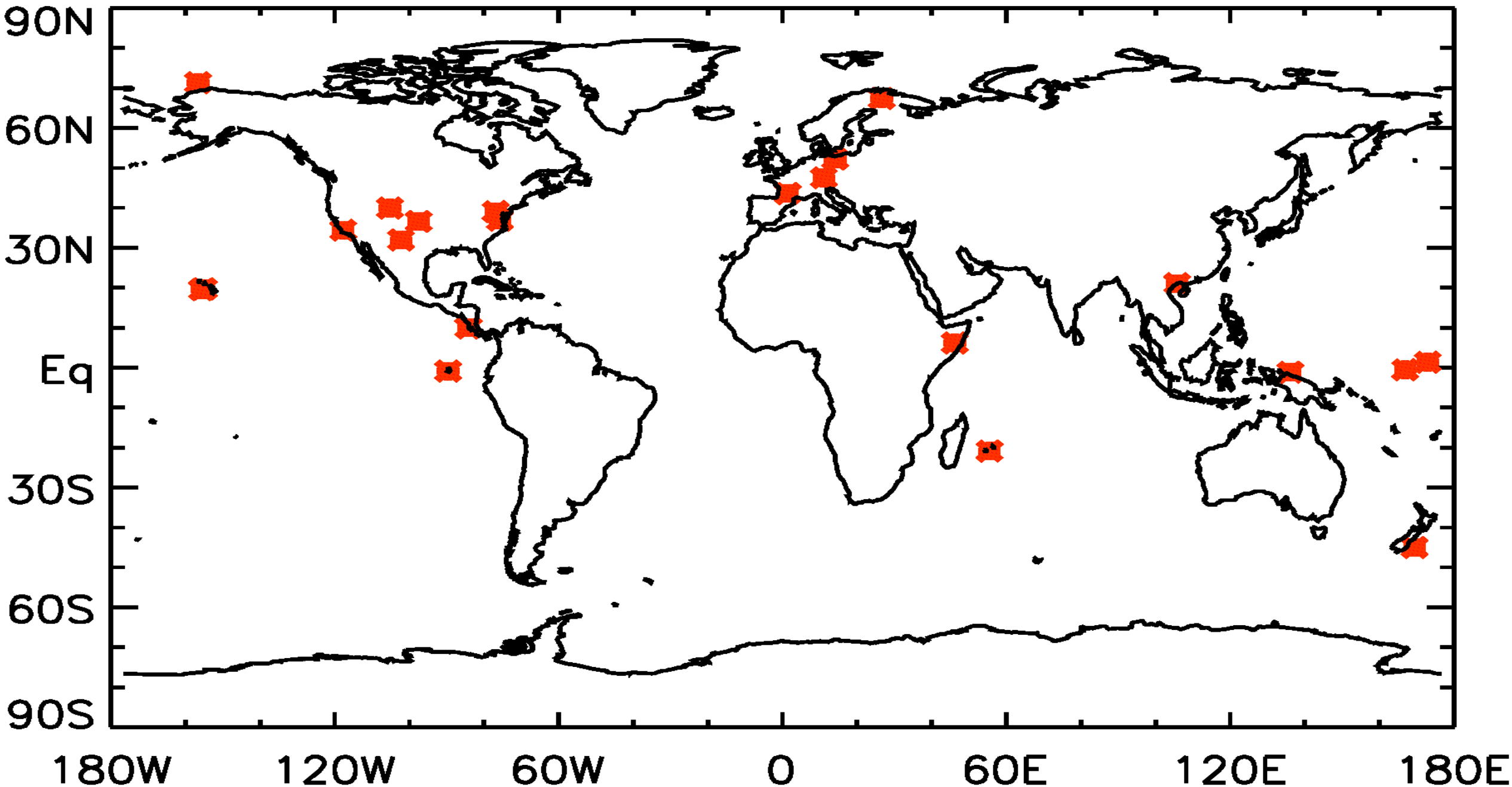
Conclusions:

- AIRS V6 biases and RMSE are close to ECMWF's for quality flag = 0, but higher than ECMWF's for quality flag = 0 or 1, in particular in the lower troposphere and in condition with thick clouds

- AIRS V6 reduces the Neural Network's (1st Guess) errors in upper troposphere for thin-cloud condition, but enhances the errors in the lower troposphere or in thick-cloud condition

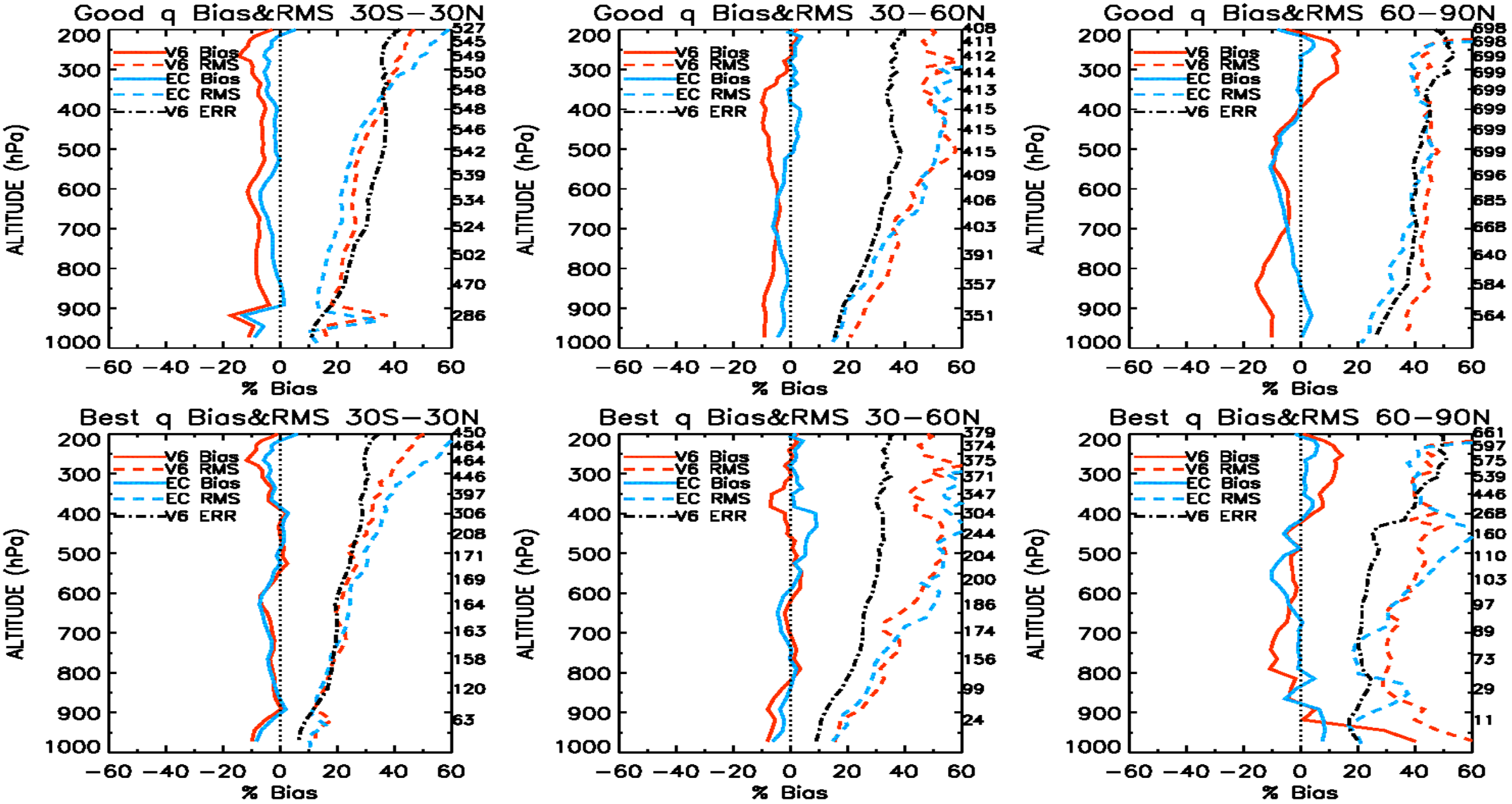
- Errors reported in the V6 product tend to underestimate the T uncertainties everywhere and q uncertainties in mid latitudes

Dedicated Sonde Sites



q Bias and RMSE (%) Profiles

30°S-30°N | 30°-60°N | 60°-90°N

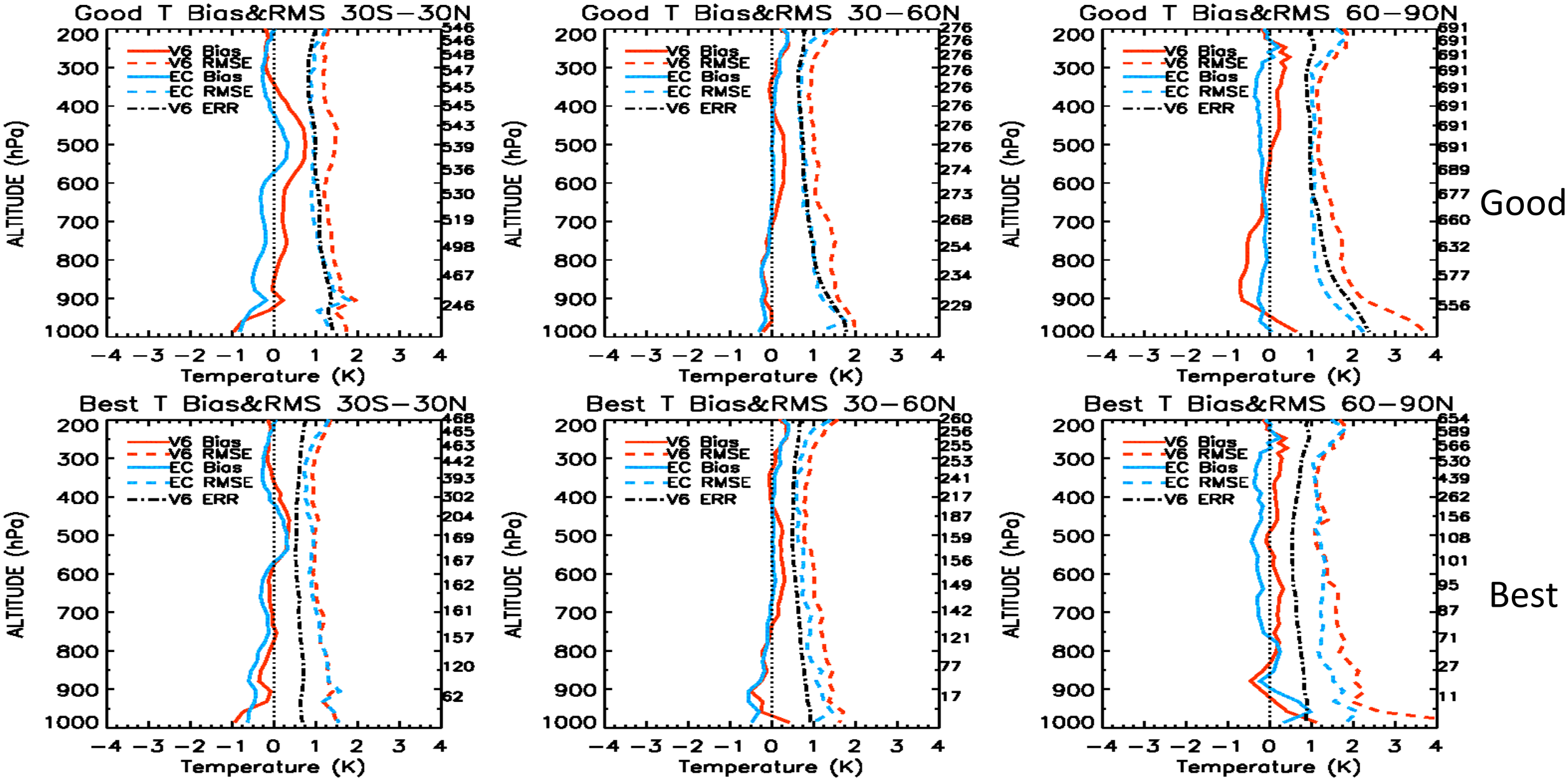


Good

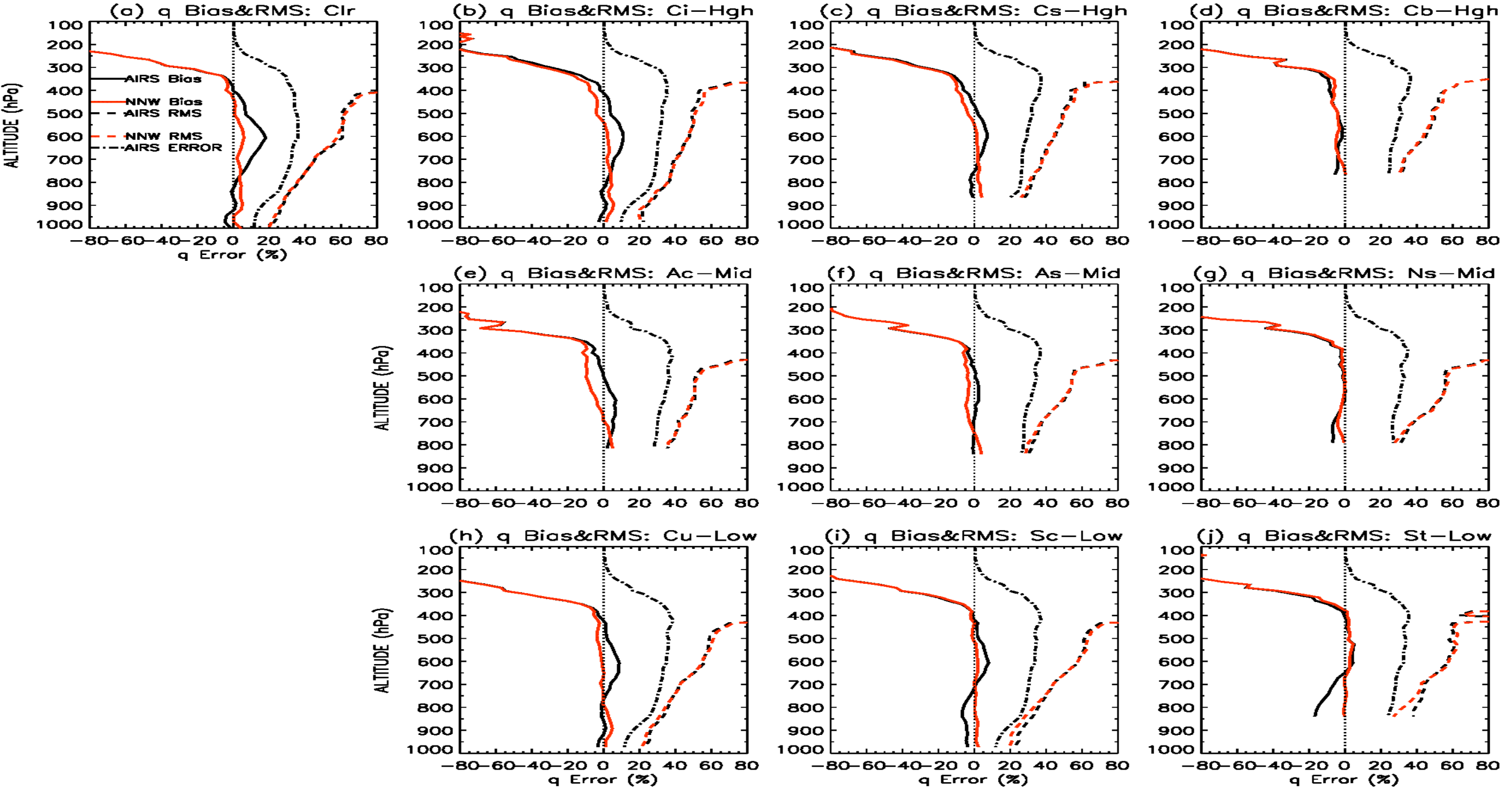
Best

T Bias and RMSE (%) Profiles

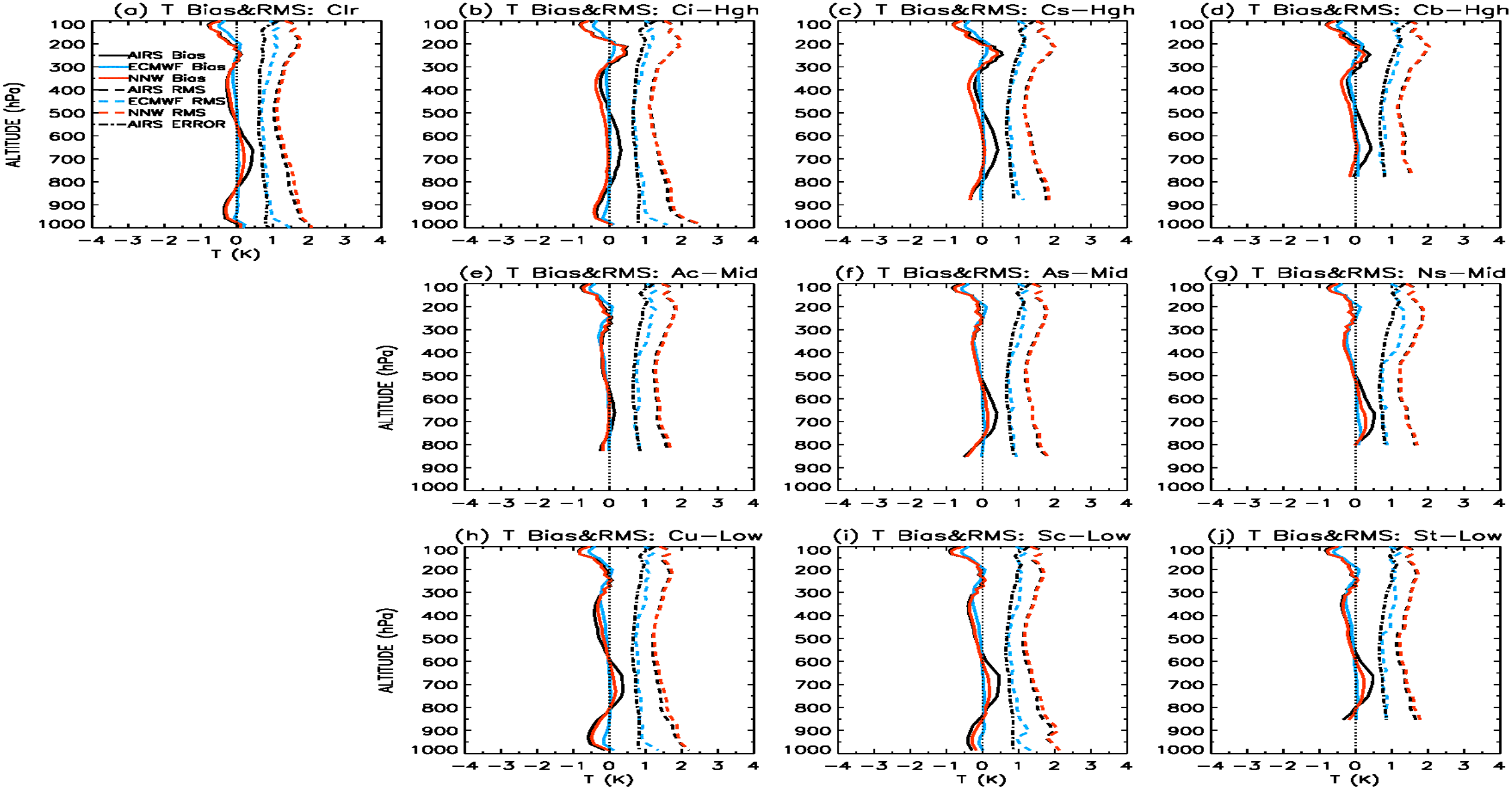
30°S-30°N | 30°-60°N | 60°-90°N



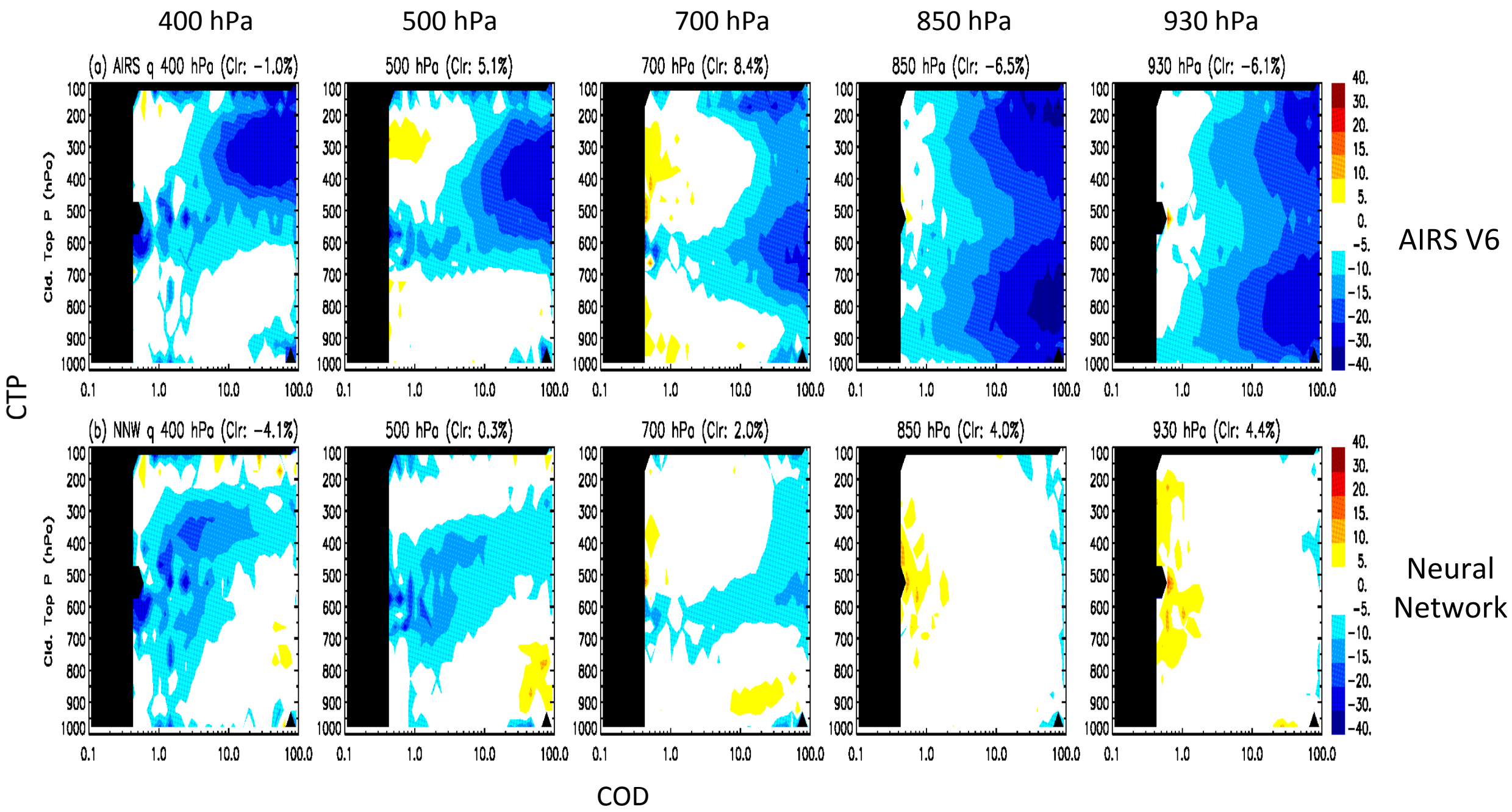
Best q Bias and RMSE (%) Profiles for different Cld. Types



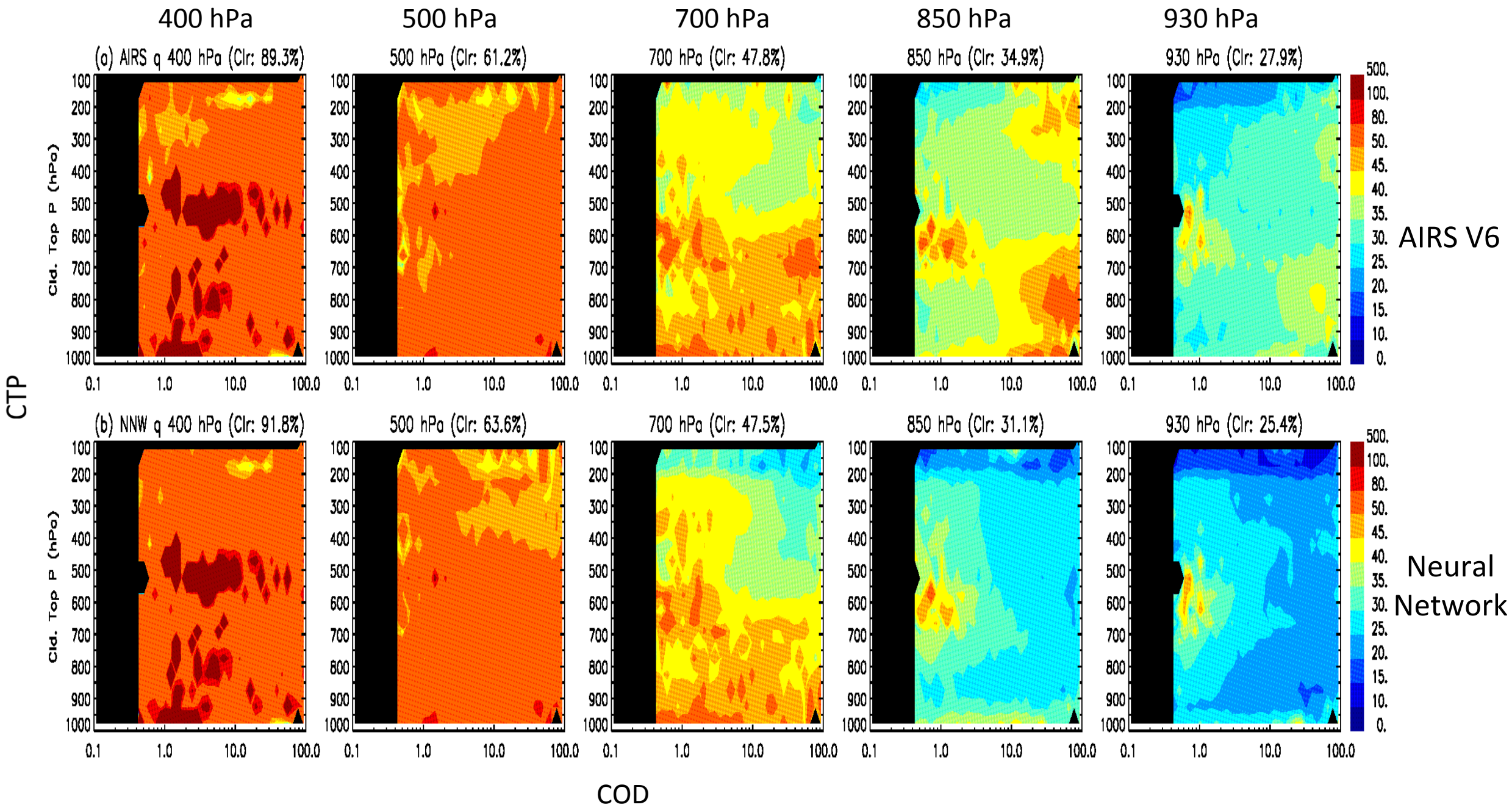
Best T Bias and RMSE (K) Profiles for different Cld. Types



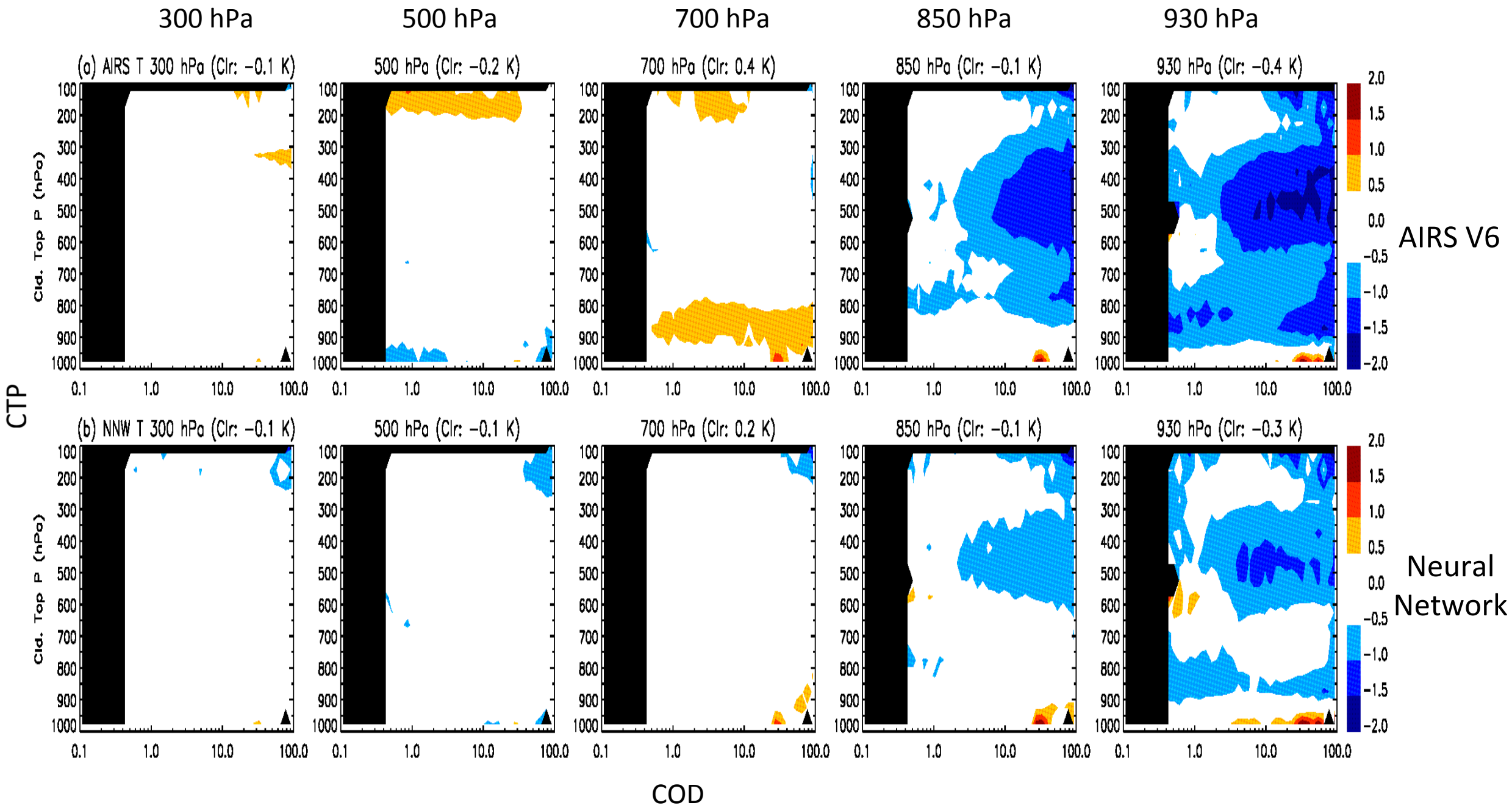
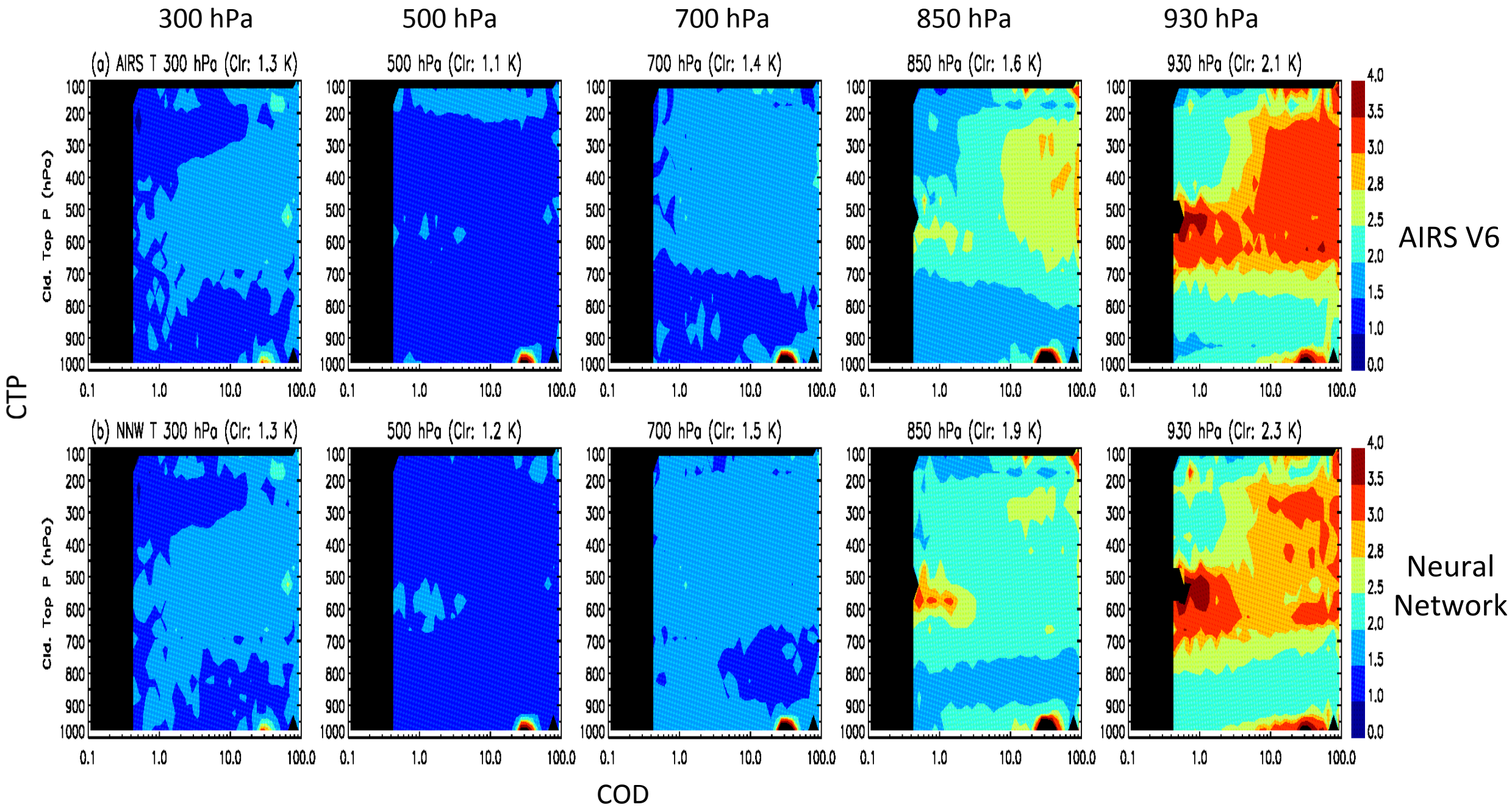
q Biases (%) as functions of CTP and COD



q RMSE (%) as functions of CTP and COD



T Biases (K) as functions of CTP and COD



T RMSE (K) as functions of CTP and COD