Validation of AIRS Cloud-Clearing Algorithms

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Overview

- Cloud Clearing (C.Y. Cho)
  - Stochastic cloud-clearing and estimation of NCEP SST
  - Cloud-clearing enhancement with AMSU
  - Stochastic cloud-clearing vs ECMWF + SARTA 1.05

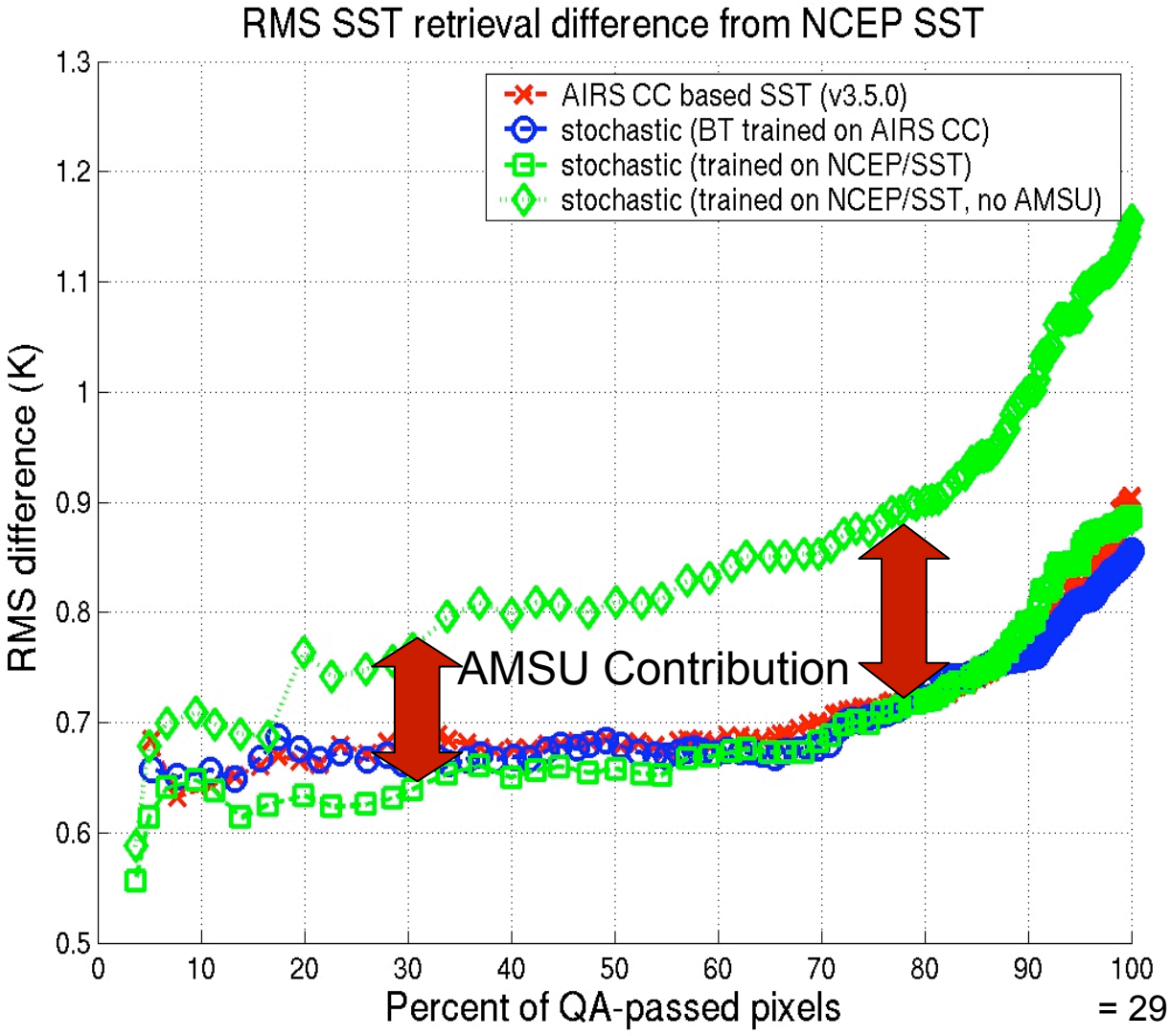
- Diurnal Variations of Precipitation (F.W. Chen)

- ECMWF/MM5 + RTE vs HSB Precipitation T_B's (C. Surussavadee)

Data Used for AIRS SST Retrieval vs NCEP

- 24 focus-day granules: 2003: 1/3, 4/9, 7/14
- Ocean, |LAT| < 40 °, |_|<16°, daytime
- Training: 1755 golfballs; testing: 1365 golfballs
- Must pass AIRS Retrieval_QA_flag test (~29% yield)
- QA-approved golfballs ranked using AIRS-cleared 1217cm^{-1} window (v.3.5.0) minus observed radiance.

SST Retrieval Results



= 29 percent of total

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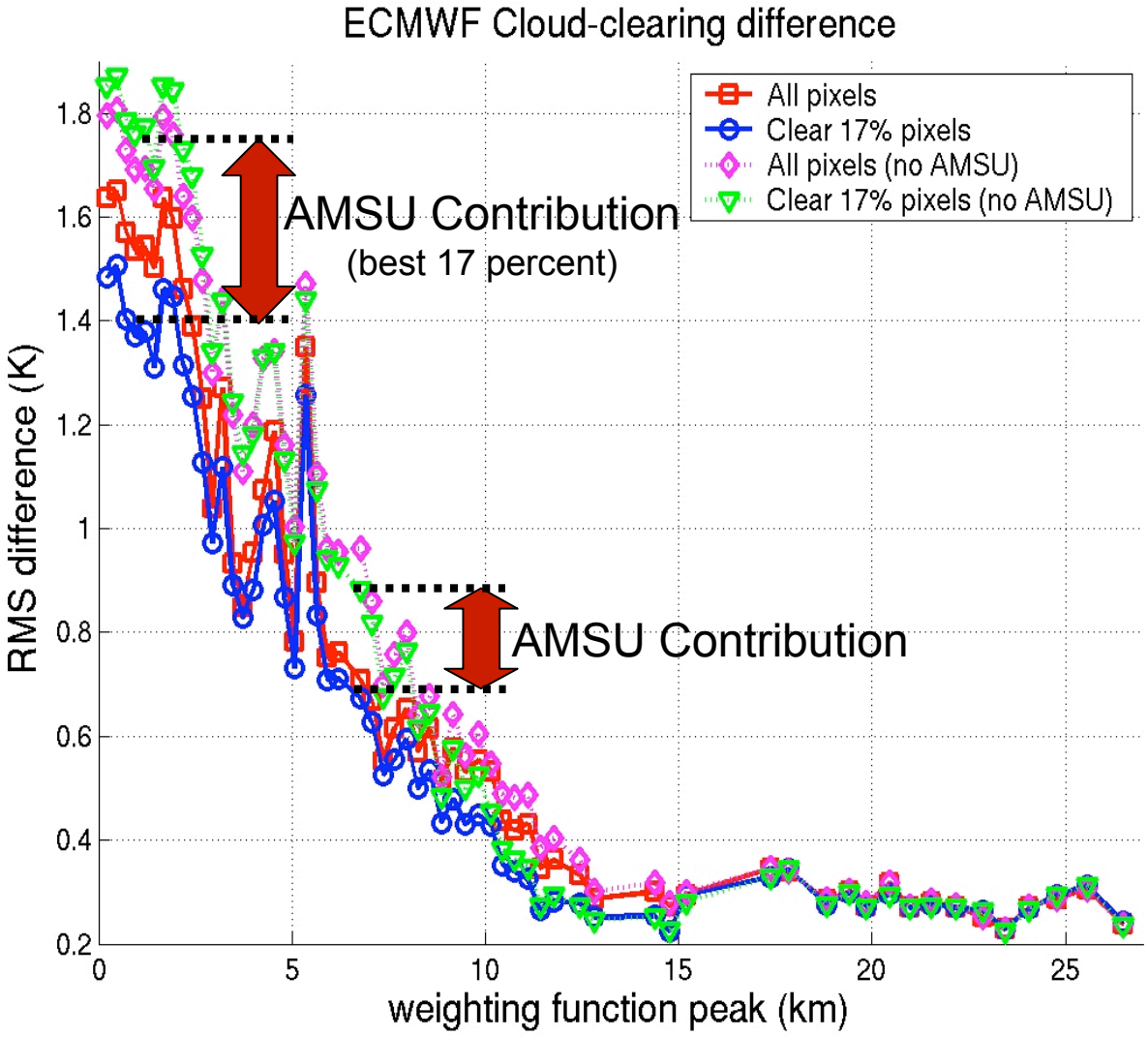
ECMWF Data Set Used

- Global data 2003: 8/21, 9/3, 10/12
- Ocean, |LAT| < 40 °, |_|<16°, daytime
- 499 golf balls for training; 499 for testing (SARTA v1.05)
- “Clear” means: (CC – observed) < 1K (17% of all GB)
- AIRS instrument noise was reduced by averaging the 2 to 9 warmest pixels as WF-peak altitude increases from the surface to ~10 km

AIRS Cloud-Clearing vs. ECMWF



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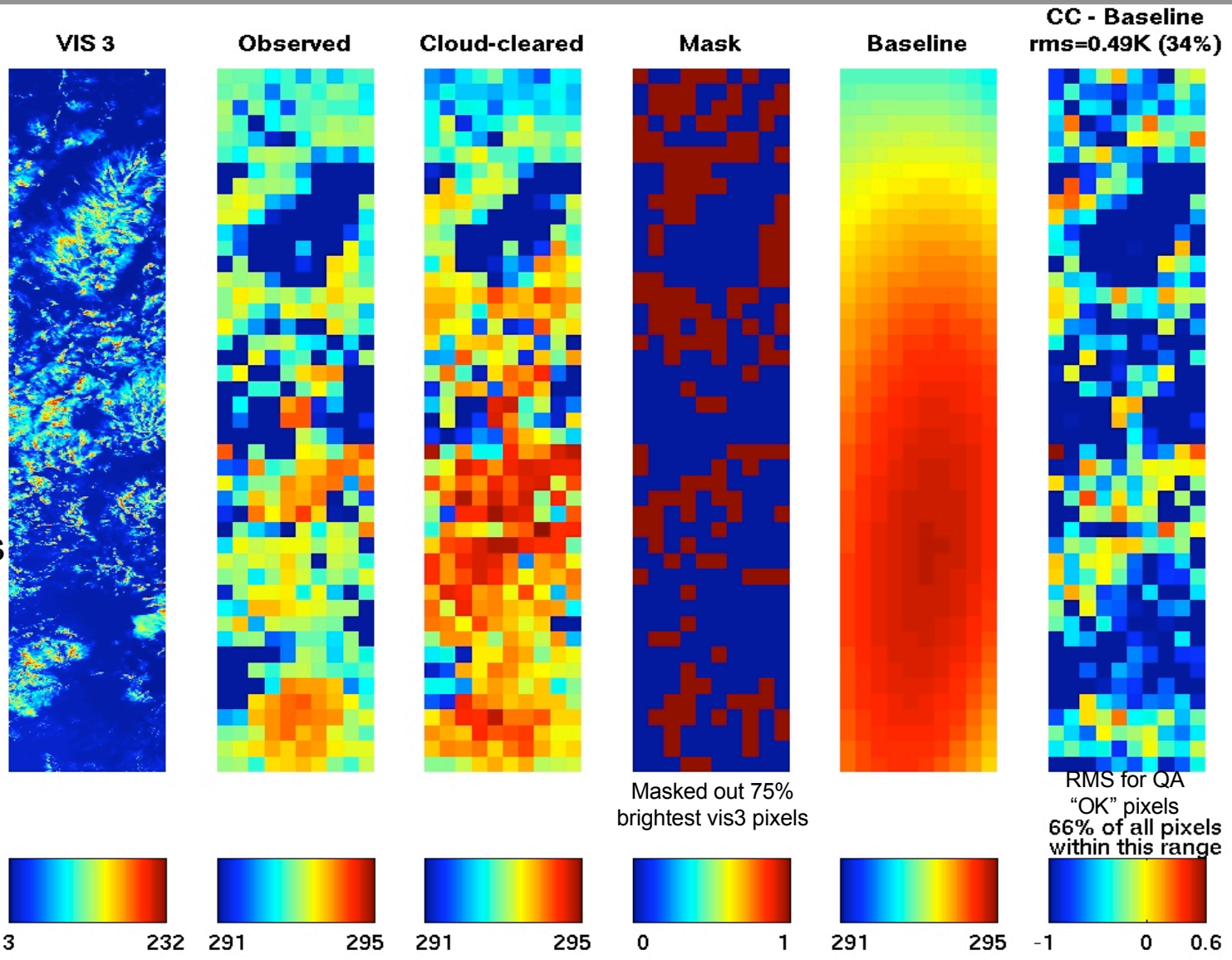
Cloud-Cleared Image

Granule# 208
7/1/03
1219 cm^{-1}
(0.22 km WF)

Baselines are QA-OK pixels Interpolated with 2-D 3rd-order polynomial



Cloud-cleared RMS relative to baseline

- RMS (^{o}K) with respect to the baseline determined by 2-D 3rd order polynomial fit to clearest pixels
- RMS is for AIRS QA "OK" pixels; percentages given below

Channels Data used	13.9 μm (WF peak ~2.9 km)	13.1 μm (WF peak ~1.7 km)	8.2 μm (WF peak ~0.2 km)
4/9/03 #92	0.38 (48%)	0.74 (48%)	0.63 (48%)
1/3/03 #208	0.28 (31%)	0.49 (31%)	0.39 (31%)
7/14/03 #208	0.26 (34%)	0.51 (34%)	0.49 (34%)

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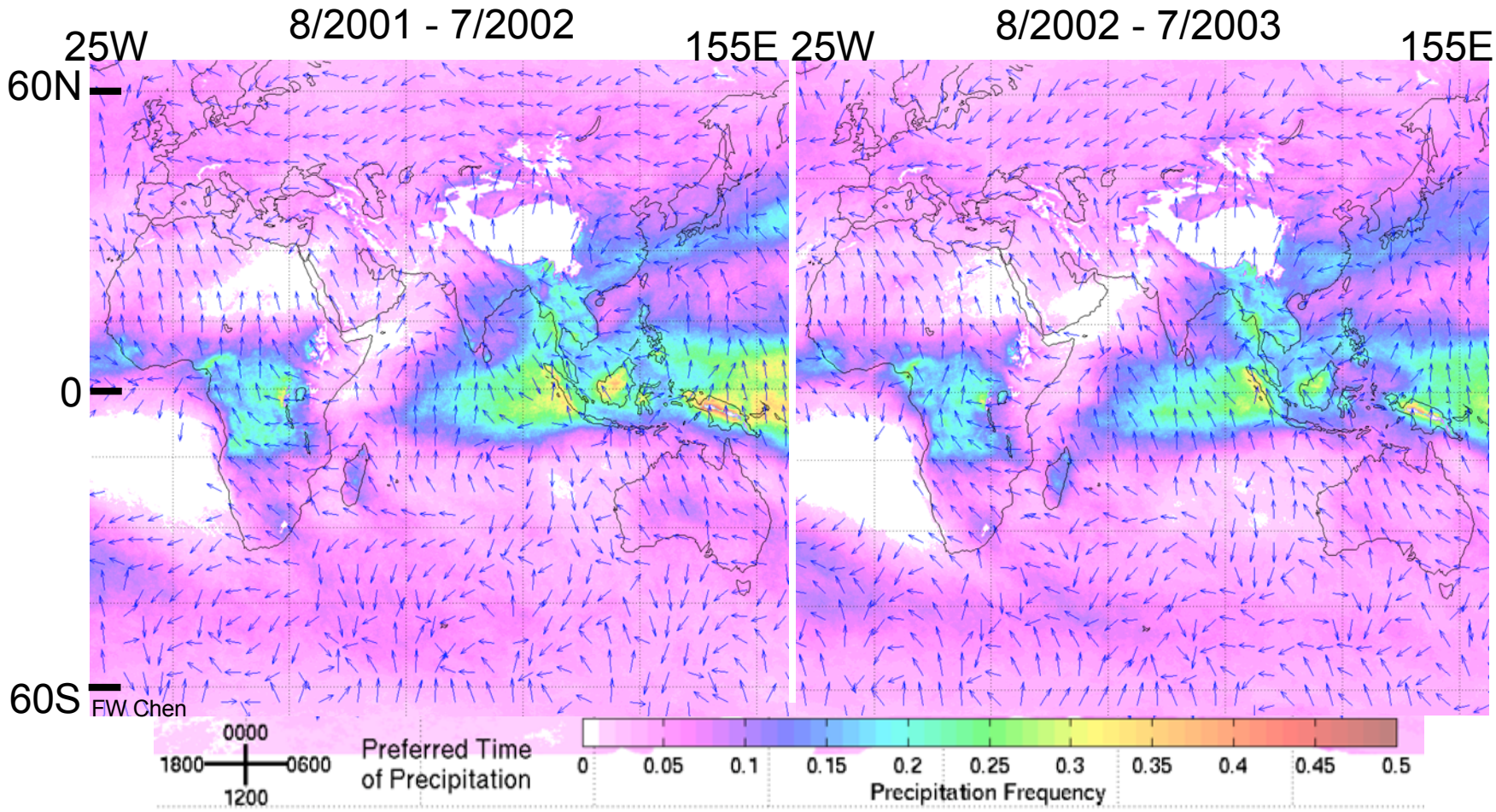
Diurnal Variation of Precipitation – AMSU

Precipitation Frequency, ~LT maximum



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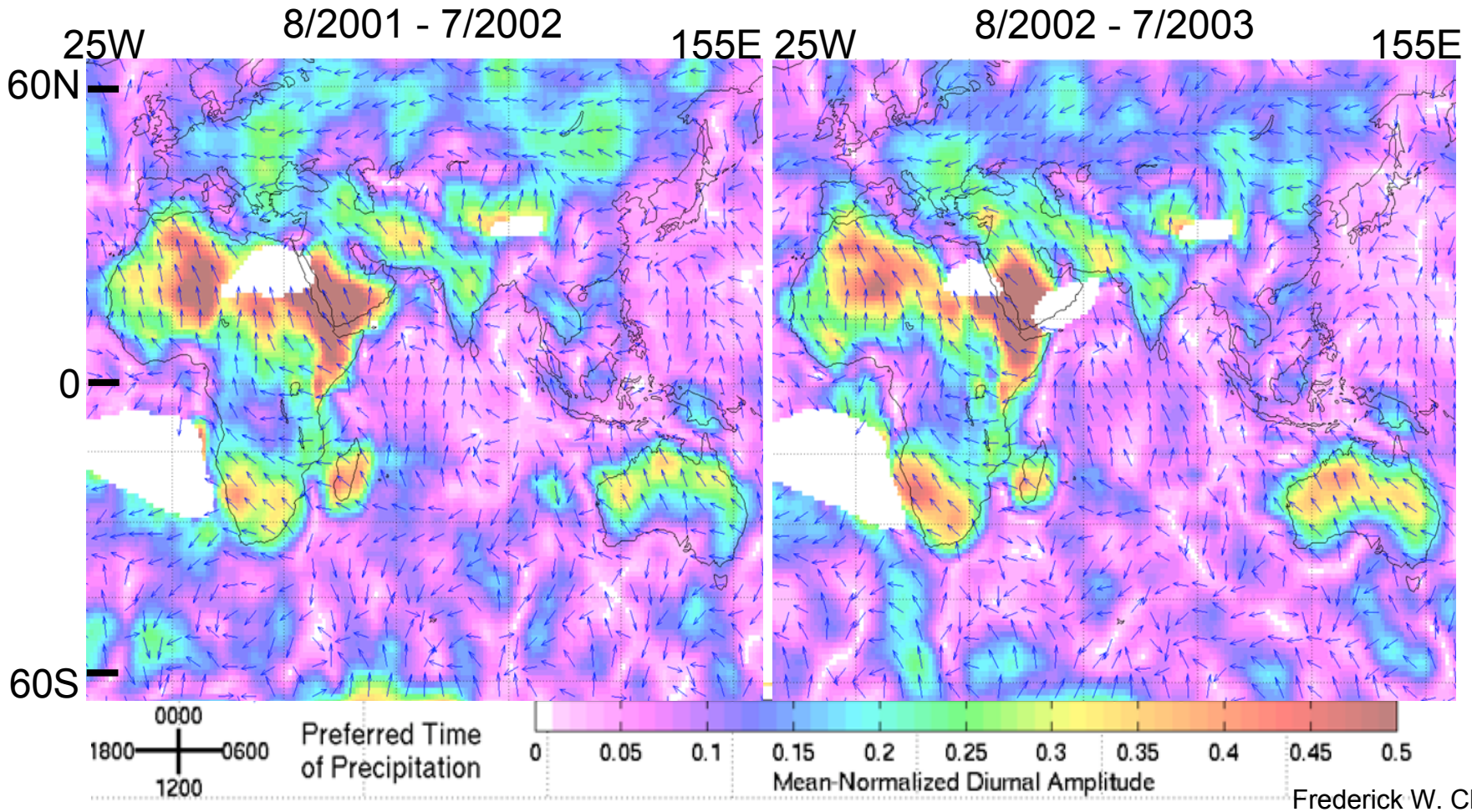
Diurnal Variation of Precipitation – AMSU

Mean-Normalized Diurnal Amplitude



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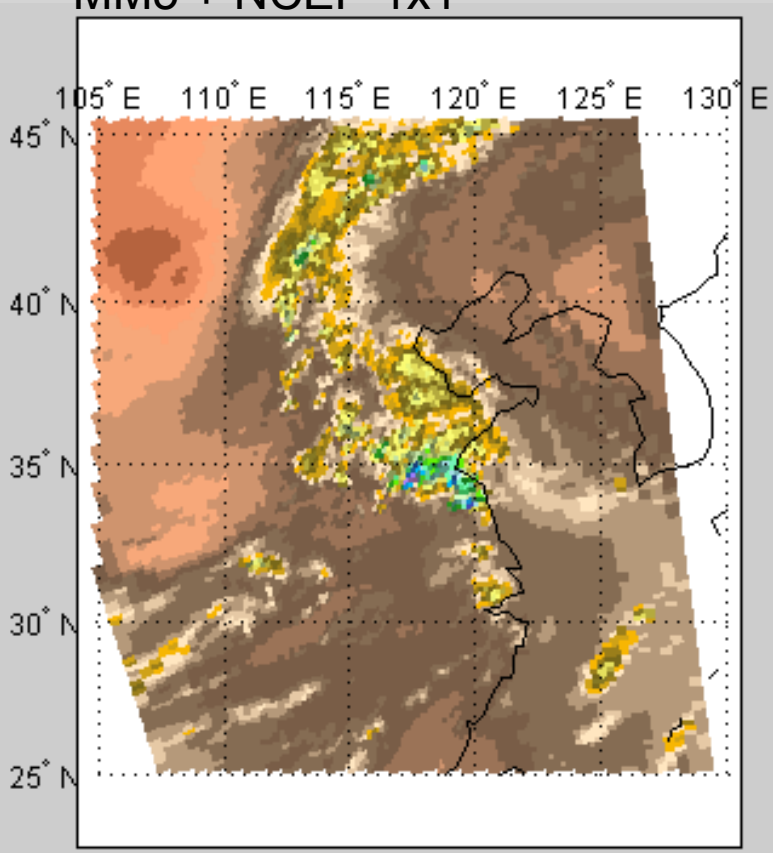
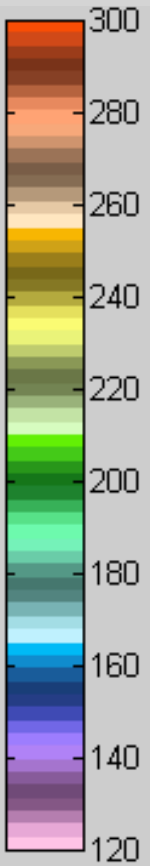
MM5 Brightness Temperatures vs. AMSU

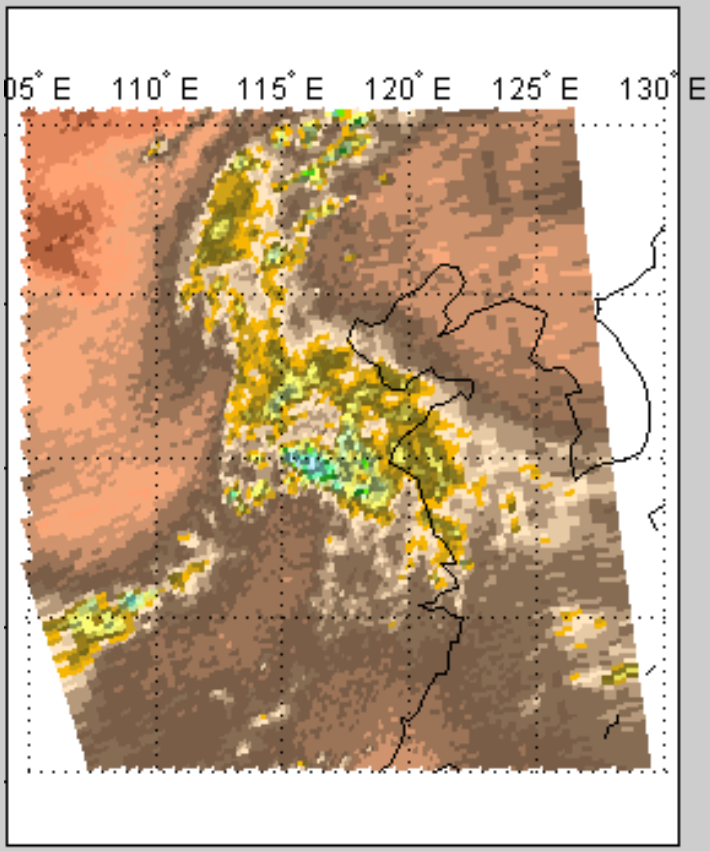
183±7 GHz June 22, 2003 15-km resolution

MM5 + NCEP 1x1°





AMSU



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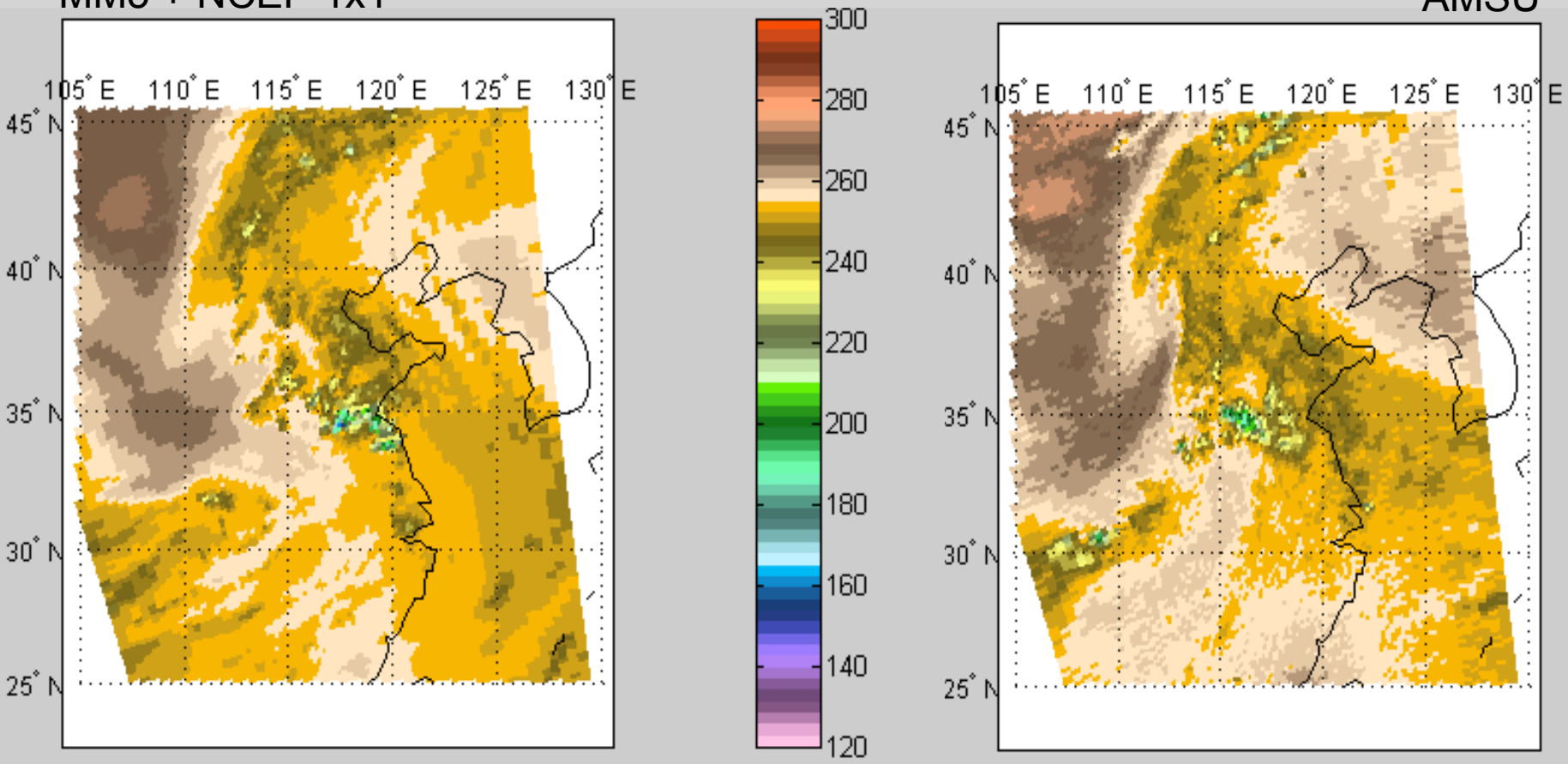
MM5 Brightness Temperatures vs. AMSU

183±3 GHz June 22, 2003 15-km resolution

MM5 + NCEP 1x1°

AMSU



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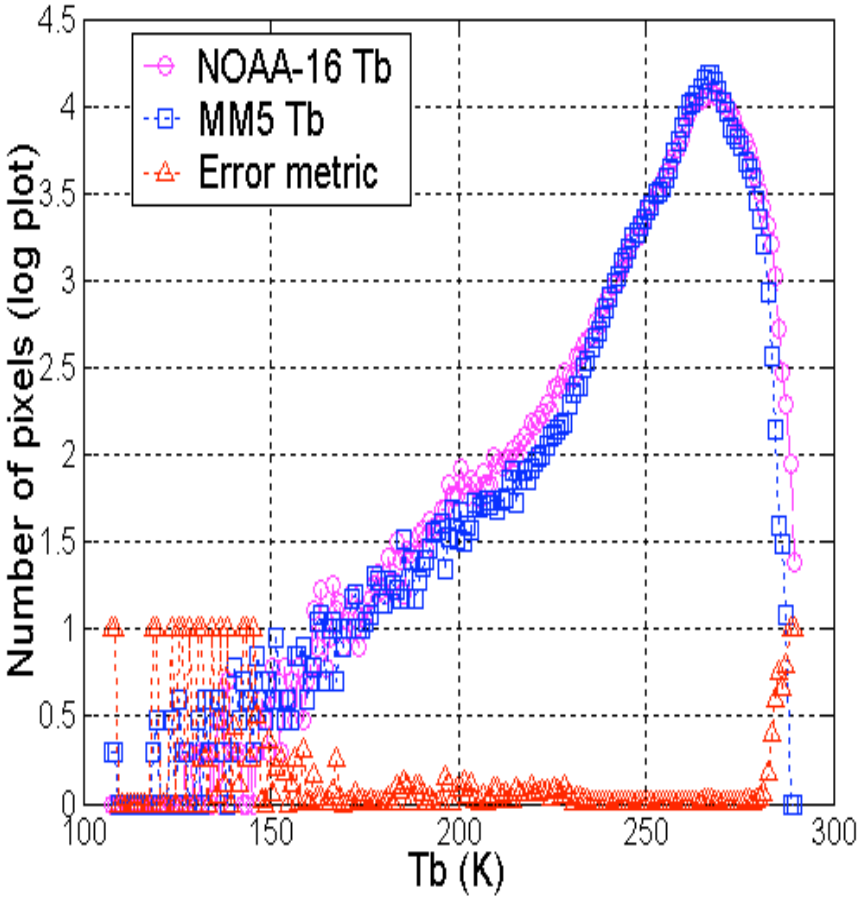
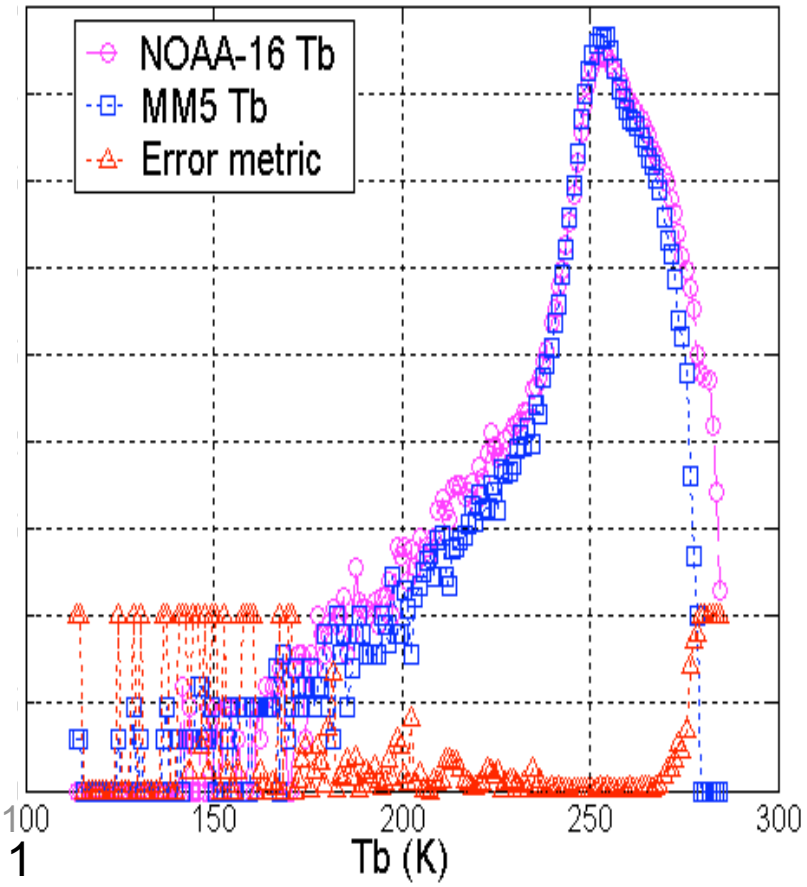
HISTOGRAMS OF MM5 vs. AMSU-B T_B'S

Average of 20 storm systems at 15-KM resolution

Channel 5: 183 ± 7 GHz



Channel 4 183 ± 3 GHz



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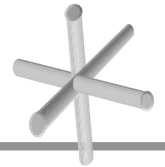
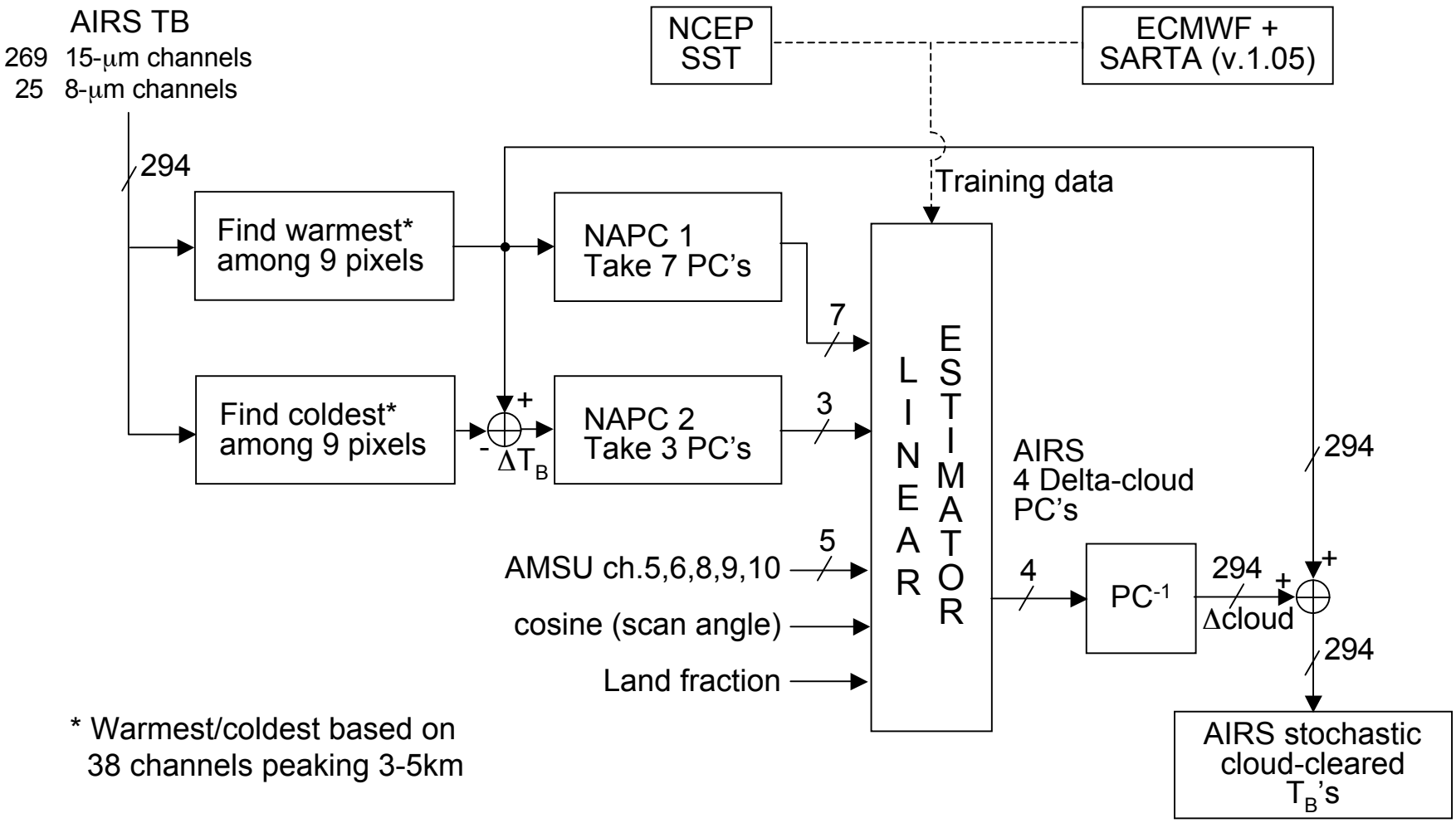
Summary of Results

- **Cloud Clearing:**
  - AIRS CC (v.3.5.0) yielded ~0.67 K rms w.r.t. NCEP SST (~20% of all pixels; 24 granules)
  - Stochastic cloud-clearing yielded: <~1° rms vs. ECMWF (>3-km); <0.6K rms (>7 km)
  - AMSU improves cloud-clearing vs SST and ECMWF
  - ~0.26 - 0.74K rms w.r.t. "baseline" for 0.2-2.9 km sample
  - Residual "CC" errors may not be due only to clouds
- **Precipitation**
  - Diurnal variations robust and informative; AMSU unique
  - MM5 brightness statistics consistent with AMSU/HSB (early results most consistent with 3-D snow)



AIRS Stochastic Cloud-Clearing Algorithm