Comparing MOA (GEOS 5.4.1) & AIRS v005(6) Global Temperature & Humidity

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CERES SYN & EBAF gridded products use the latest version of GEOS 4/5.2 reanalysis for atmospheric state input. (T(z), q(z), etc.)

Will use version MOA/GEOS 5.4.1.

EBAF assimilates AIRS data in its initial tuning process (primarily UTRH) but also surface air and skin temperature for the 'sigmas' in the tuning process.

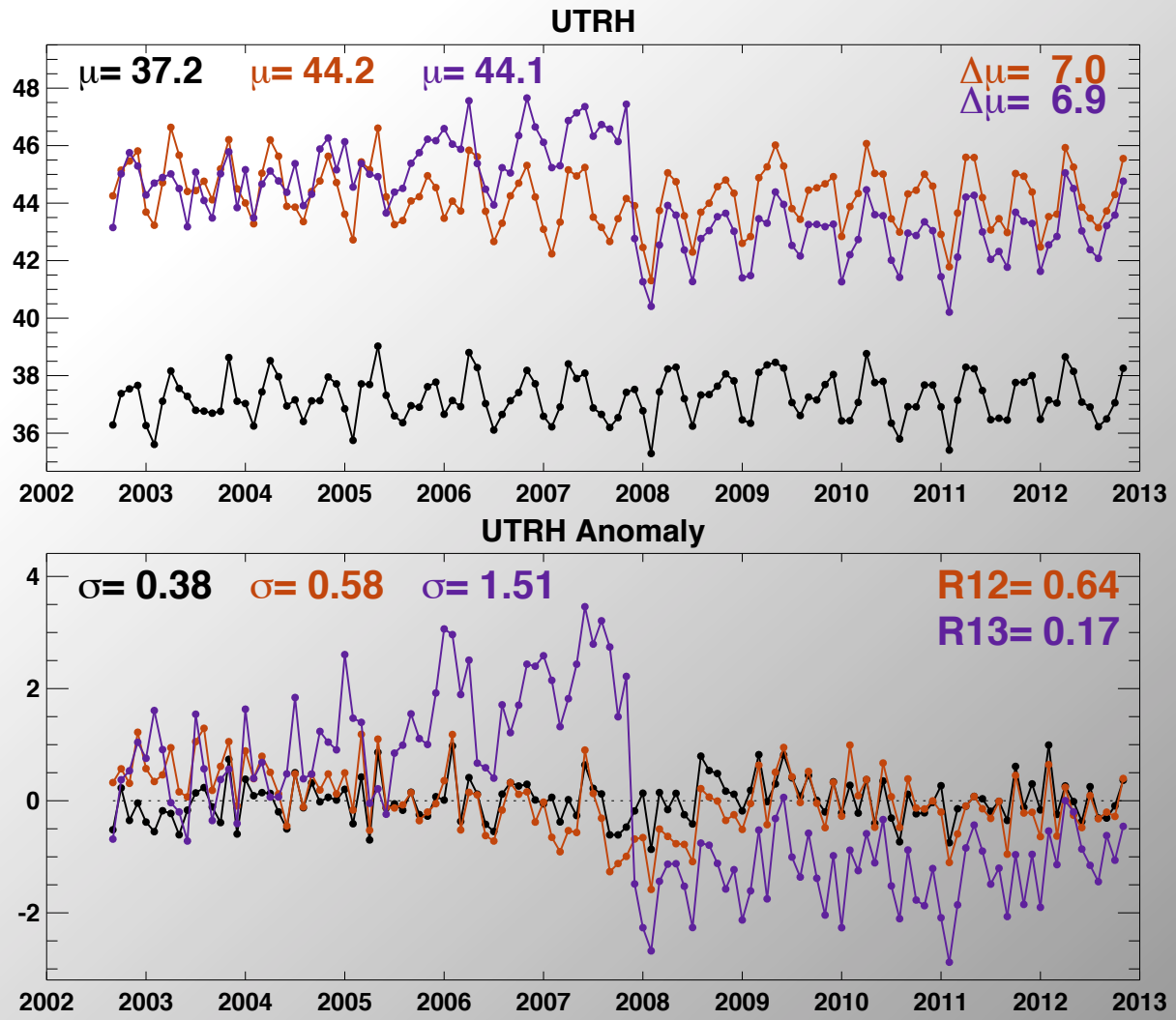
AIRS also provides global profiles of temperature and humidity
Processing switches from v005 to v006 in Oct 2011.

Big drop in UTRH from GEOS 4 to GEOS 5.2

UTRH is higher in GEOS 4 than AIRS by ~15% for whole length of record.

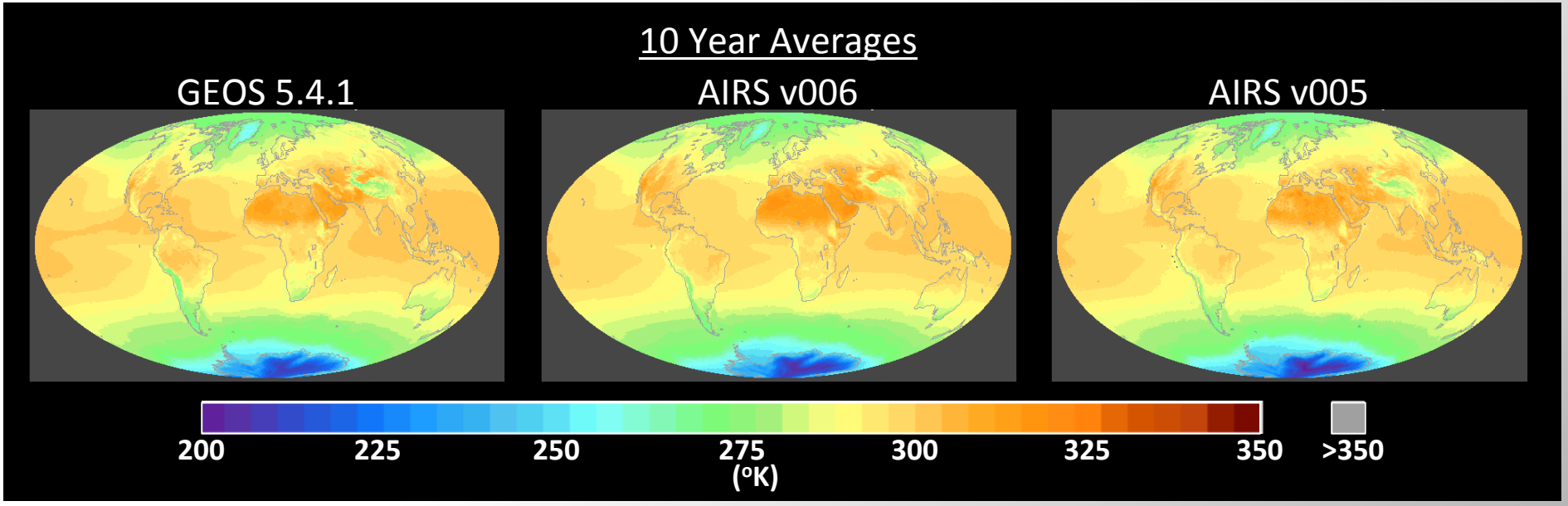
Global Monthly Mean Time Series

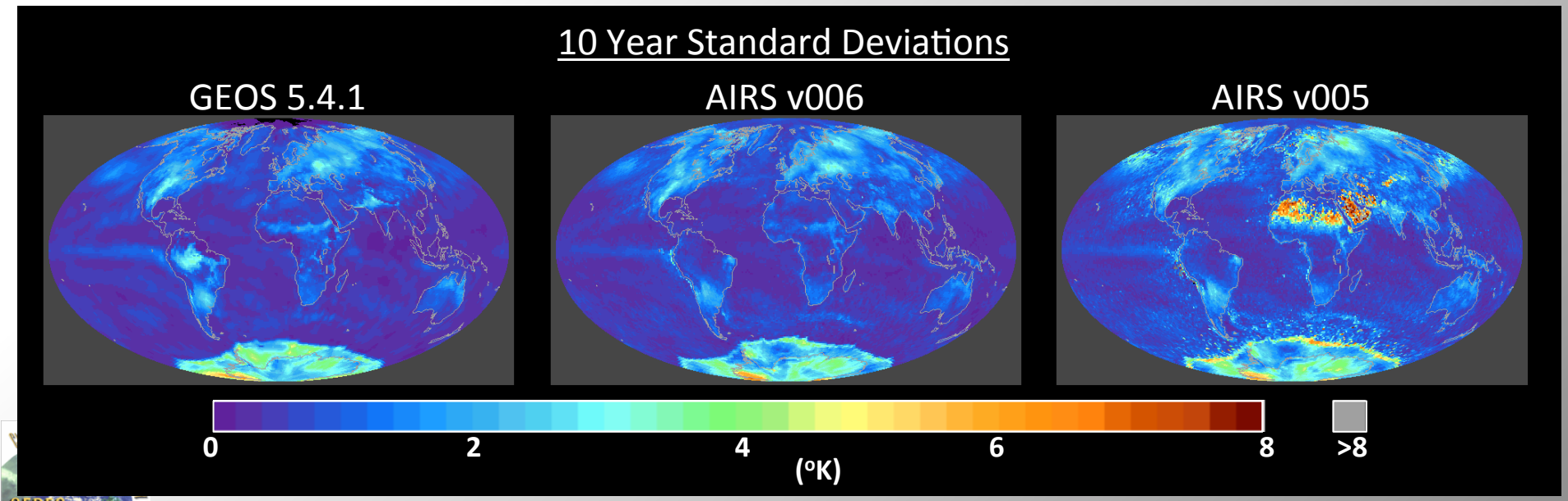
AIRS v006
GEOS 5.4.1
GEOS 4/5.2



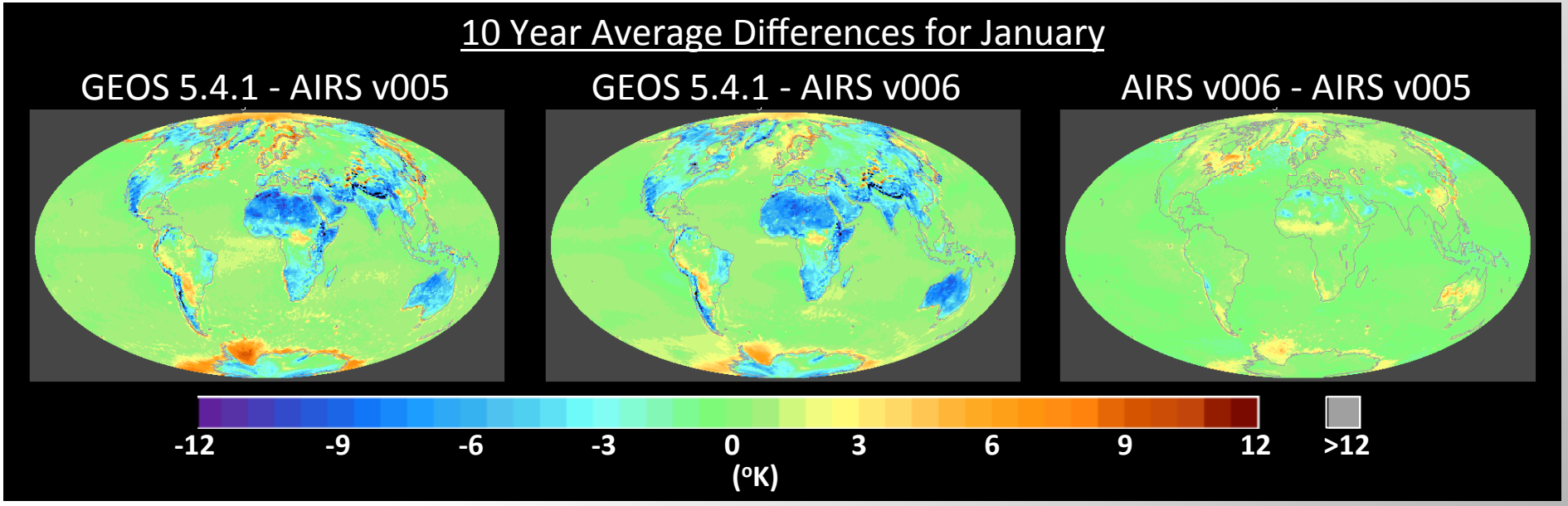
- **To analyze global maps:**
  - 10 Year average for each month (Jan & Jul)
  - Differences: (MOA/GEOS – AIRS)
  - 10 Year standard deviations
  - Consider
    - Skin Temperature
    - Air Temperature
    - Precipitable Water
    - Upper Tropospheric Relative Humidity

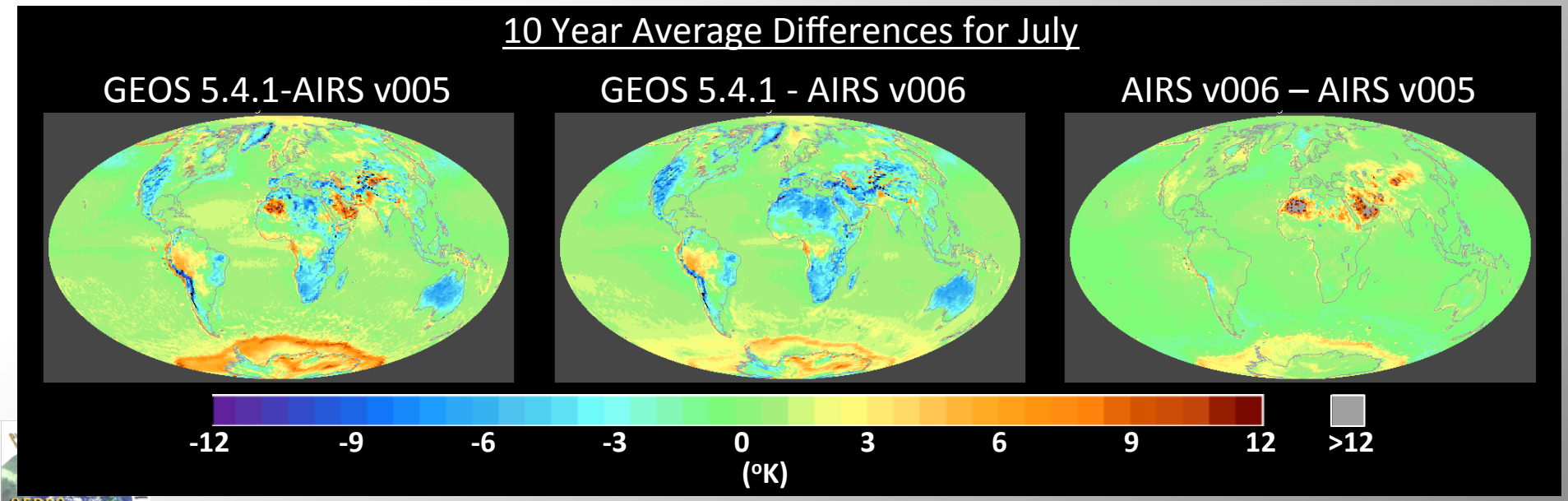
Skin Temperature (°K) – 10 Yr Average (July)



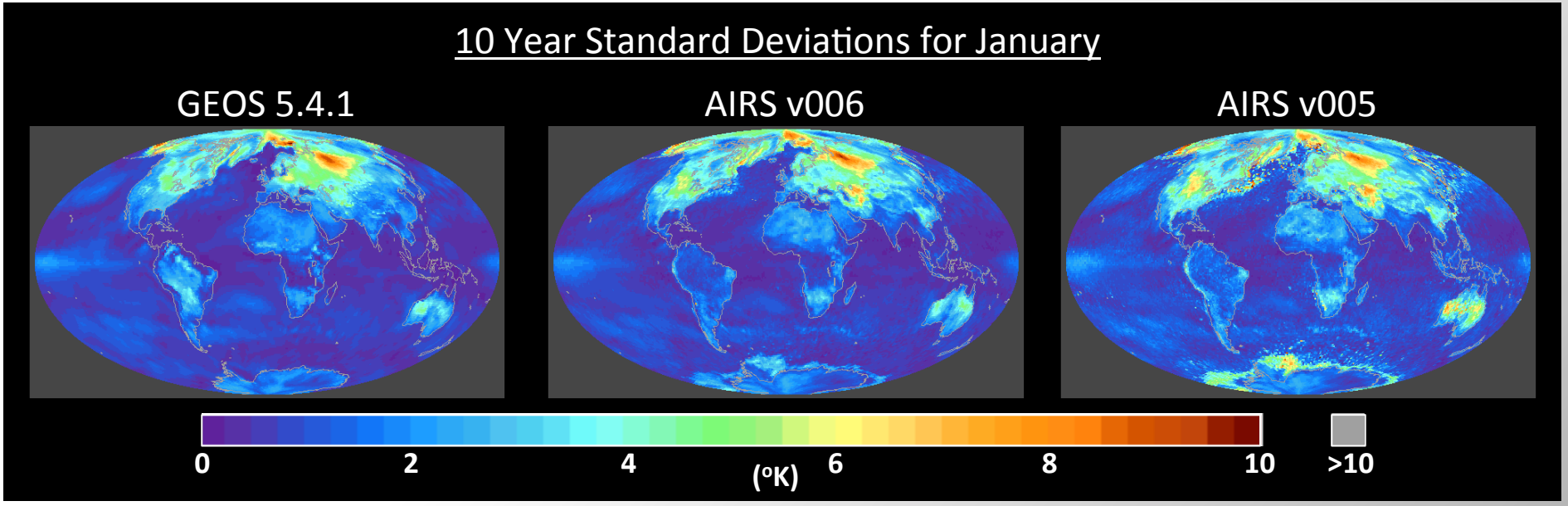


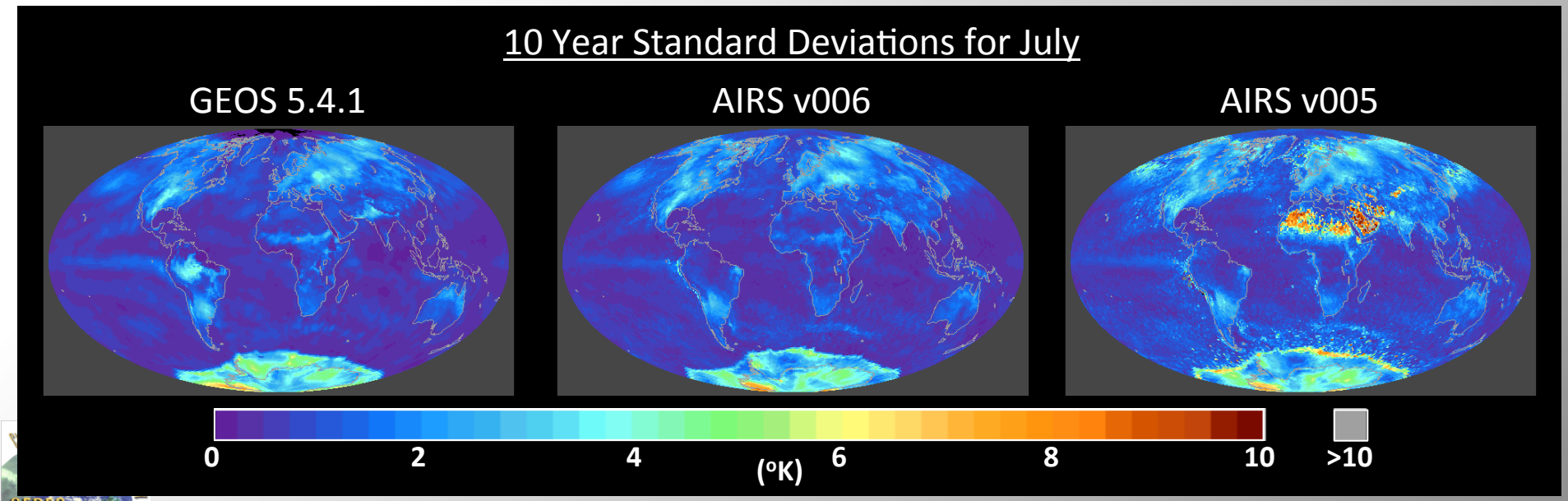
Skin Temperature Differences (°K) (January & July)





Skin Temperature Std Deviations (°K) (January & July)





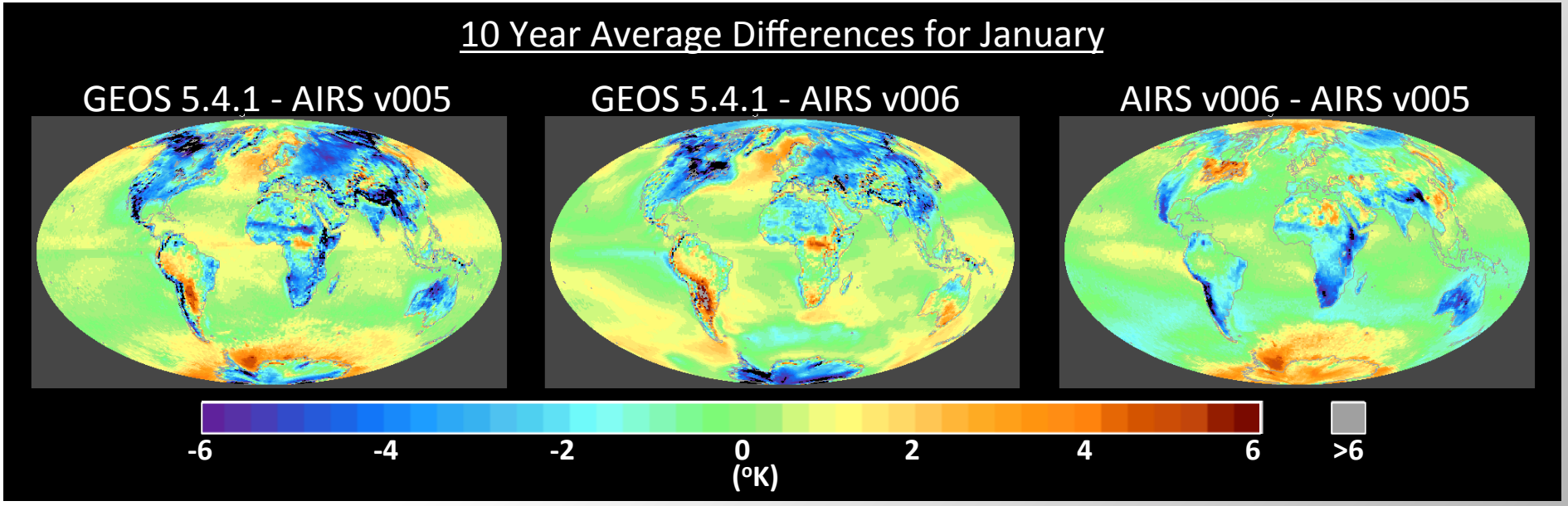
Global mean skin temperature 10 year deltas.

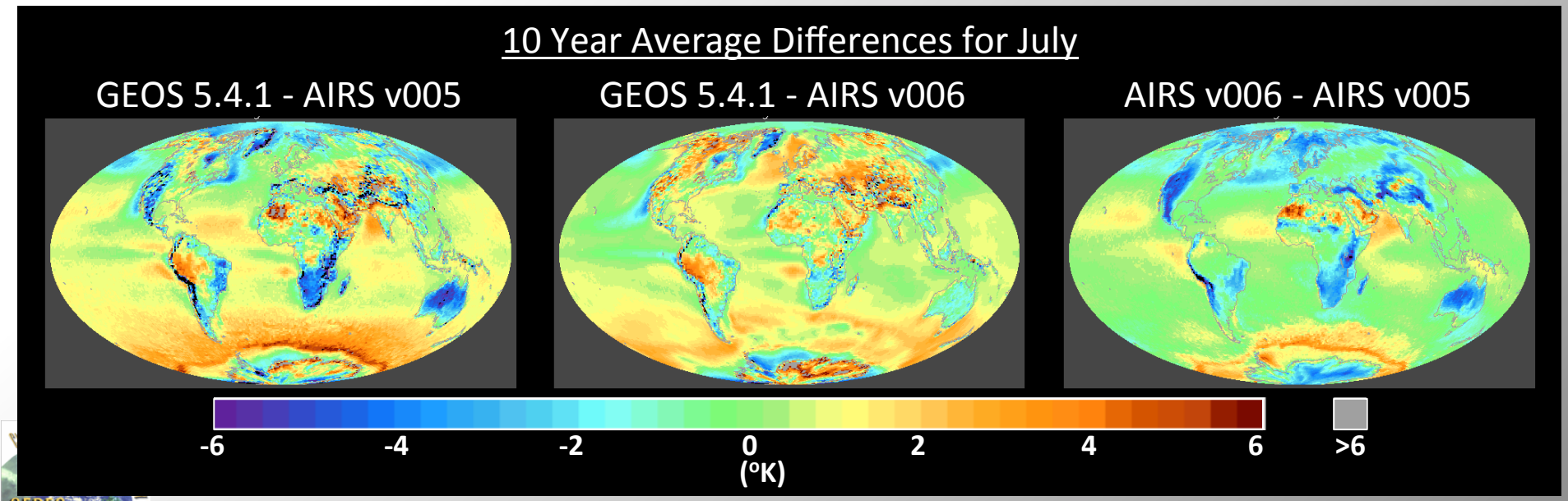
- MOA warmer over polar ice, colder over deserts (delta over deserts is larger in hemisphere summer)
- Except for positive error over W Sahara w.r.t. v005 (increased (erroneous) variability over Sahara.

Global mean skin temperature 10 year std deviations

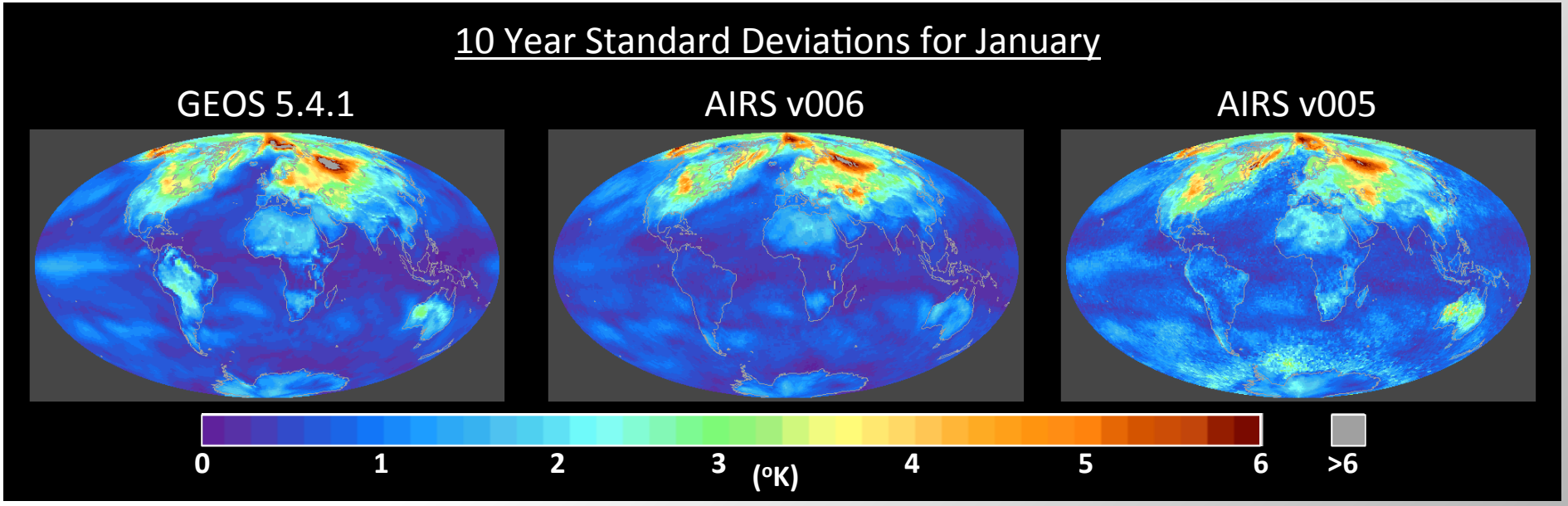
- MOA, AIRS v005(6) tend to agree on variability due to NH winter changes (snow)
- In SH, MOA shows more variability over Amazon basin and Sahel regions.
- Overall, agree well.

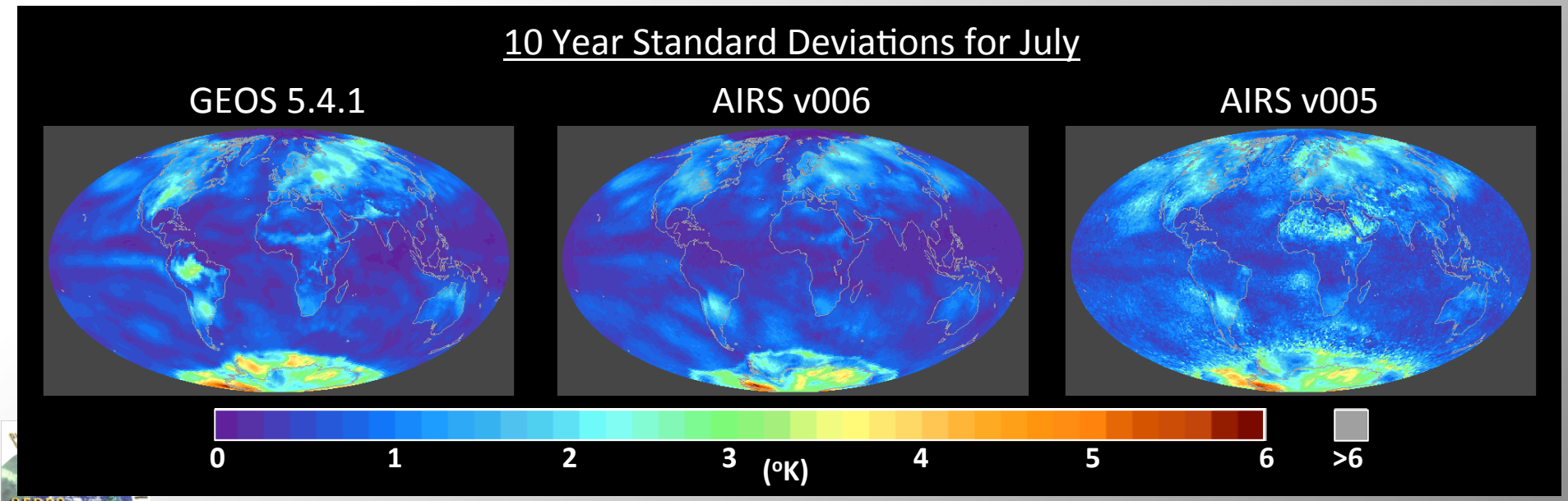
Surface Air Temperature Differences (K) (January & July)





Air Temperature Std Deviations (°K) (January & July)





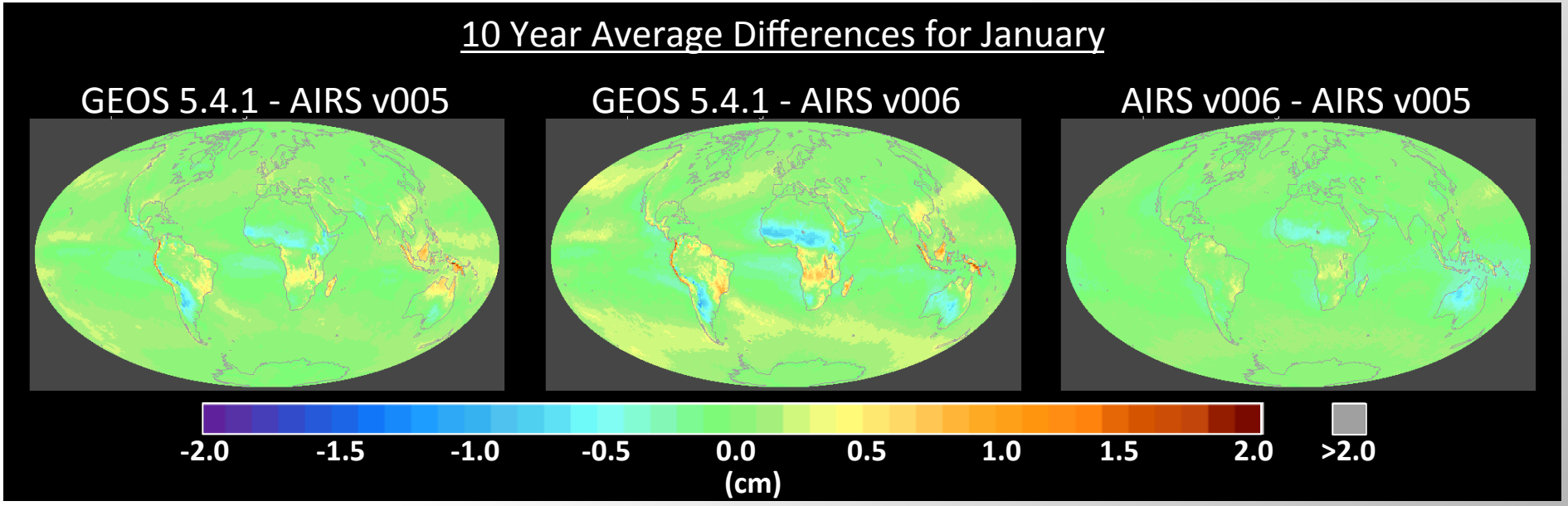
Global mean air temperature 10 year deltas

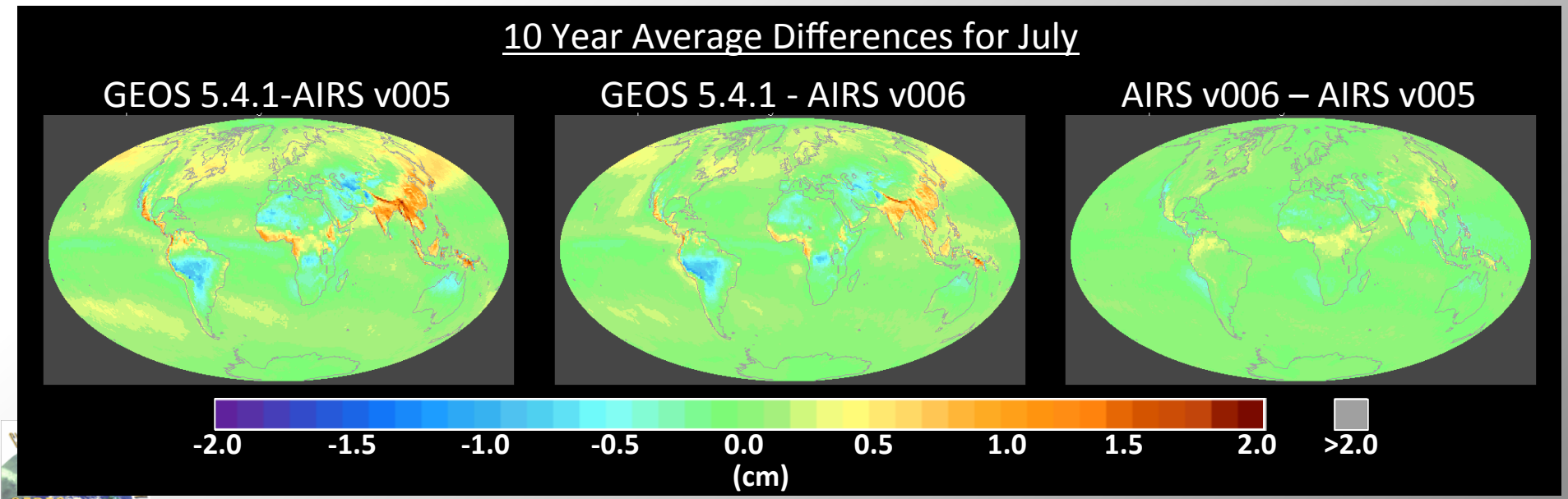
- In Jan, continental NH land colder in MOA than AIRS, except S. America, W Brazil & Patagonia.
- Fairly large difference in AIRS v005 & v006 as well over A Africa, Austrailia, S Oceans.
- In July, some large MOA warmer over S oceans by ~2degrees
- NH continents MOA now warmer than v006 and most of v005
- v006 compares better than v005 to MOA

Global mean air temperature 10 year std deviations

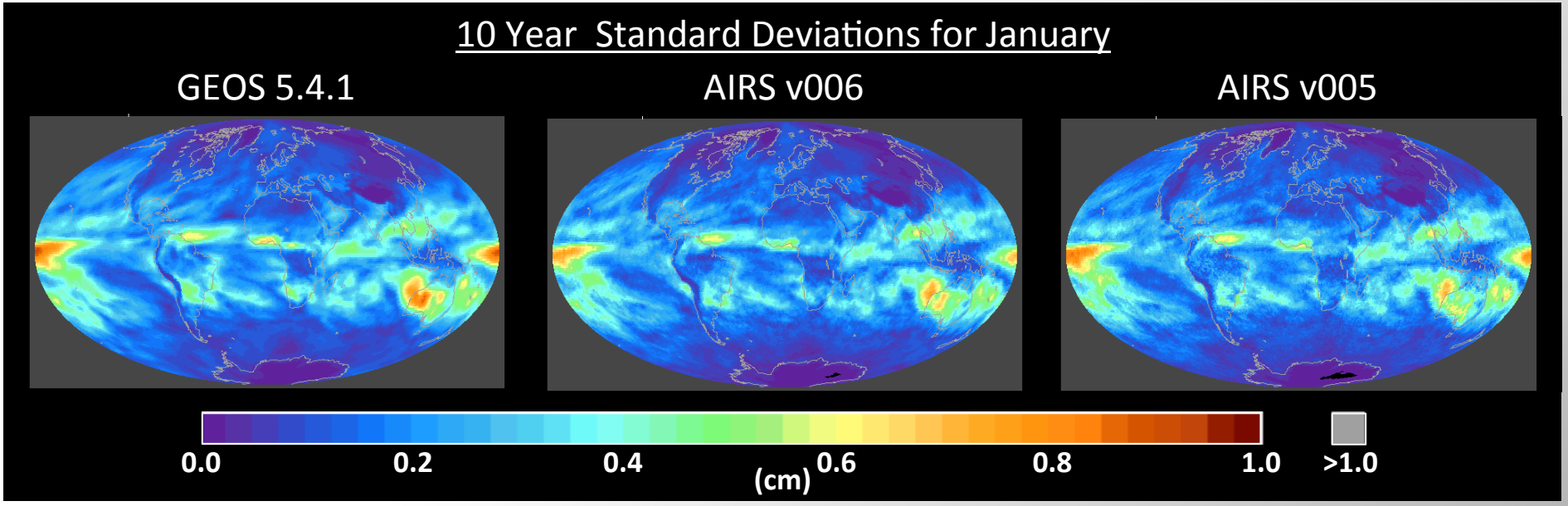
- Again MOA, AIRS v005(6) tend to agree on variability due to NH winter changes (snow)
- Again, in SH, MOA shows more variability over Amazon basin and Sahel regions & US great plains.
- Overall, agree well.

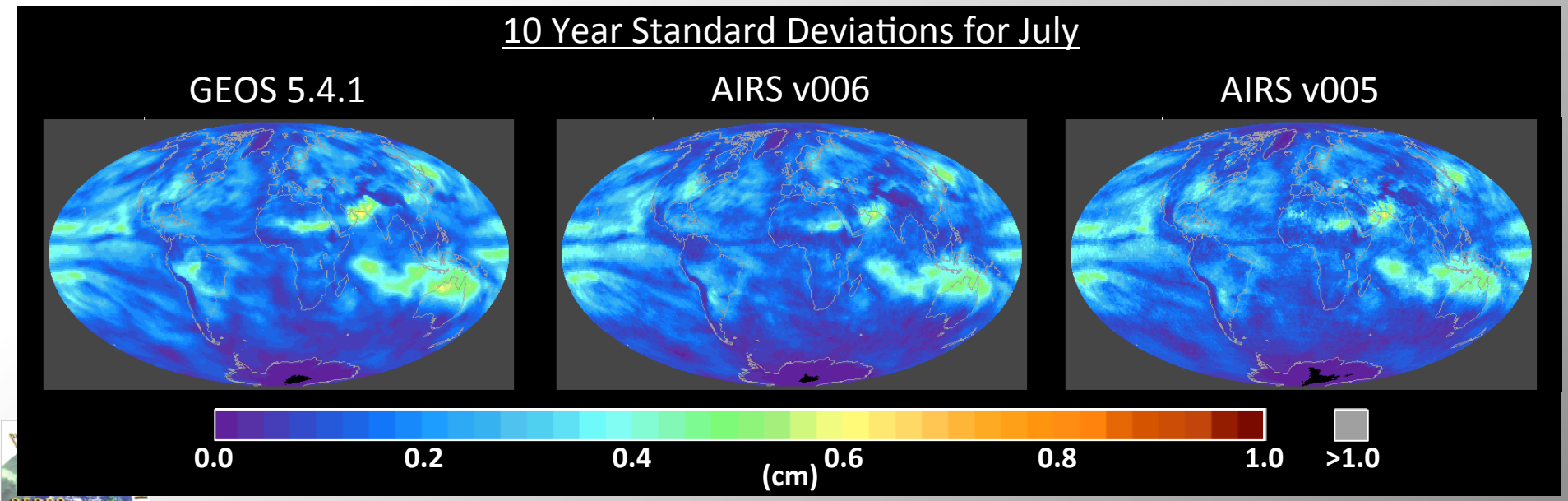
Precipitable Water Differences (cm) (January & July)





Precipitable Water Standard Deviations (cm) (January & July)





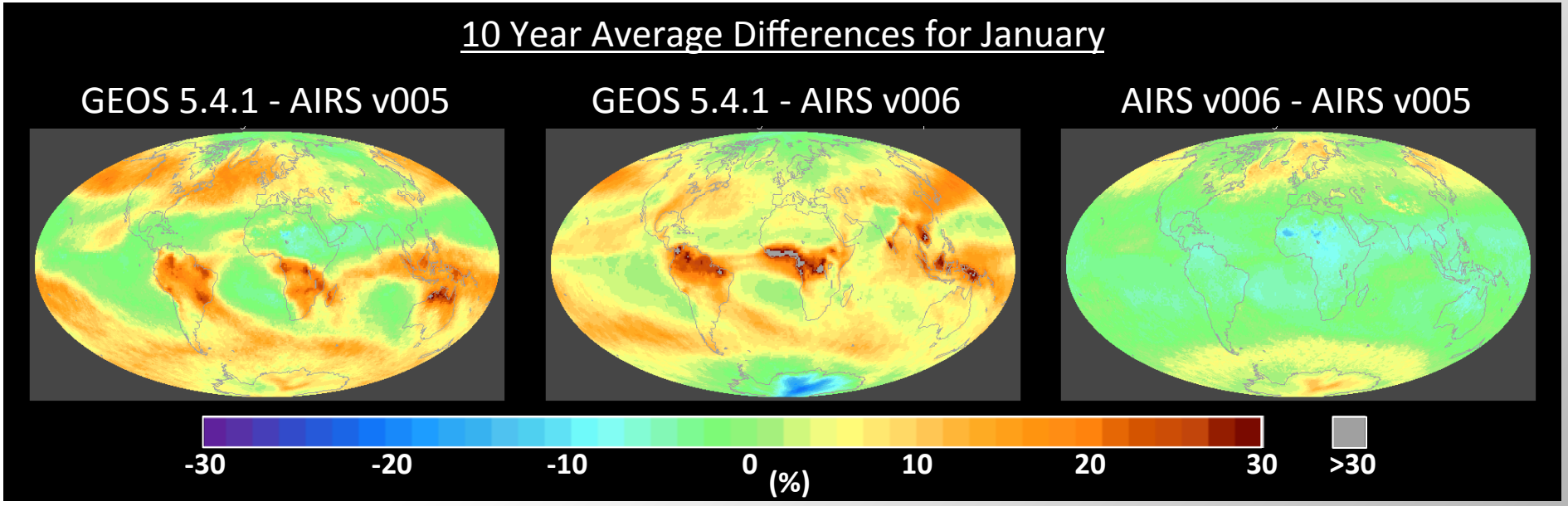
Global mean PW 10 year deltas

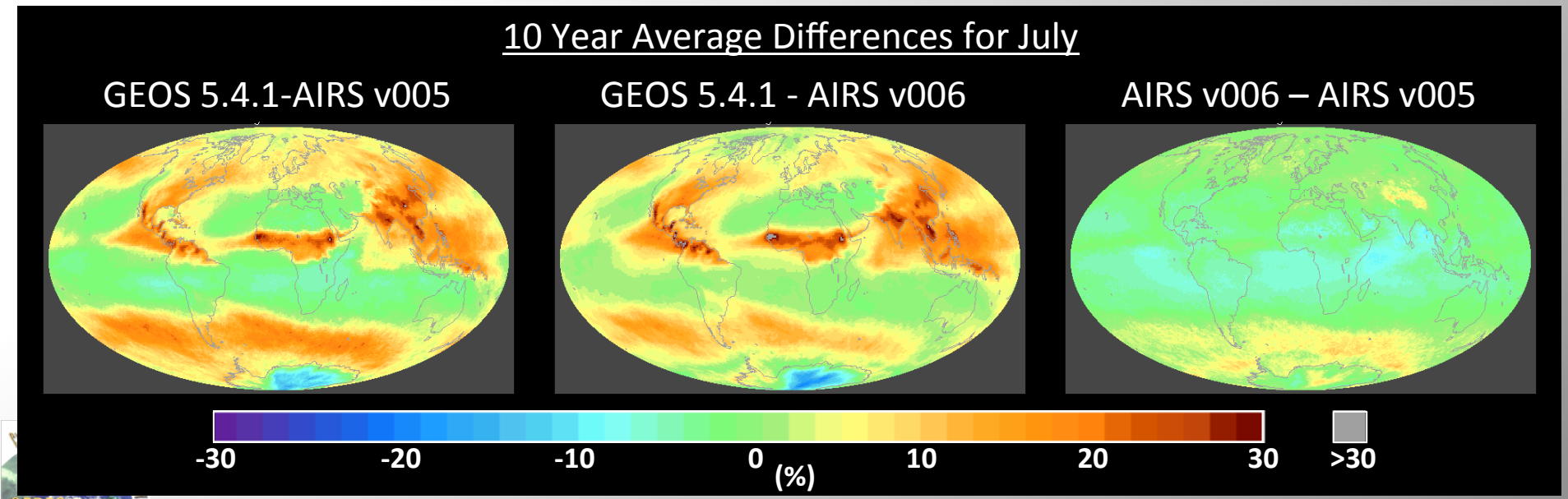
- In Jan, maps match very well over most of globe.
- in Jan MOA shows less PW than AIRS v006 over Sahel and more than v006 over maritime continent
- In July, again agree well overall.
- MOA wetter than v005(6) over India, Maritime continent, central Africa, dryer over Amazon basin.

Global mean PW 10 year std deviations

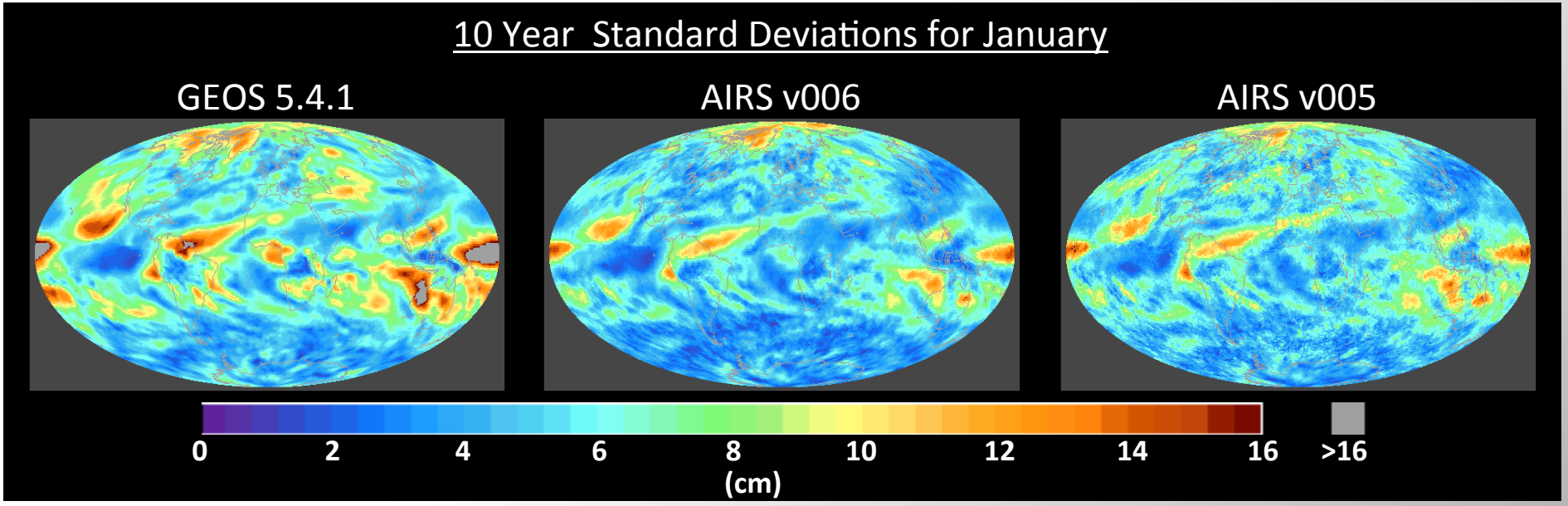
- Overall, agree well for all three data sets.
- All find an ENSO like signal in the Jan sigma maps.

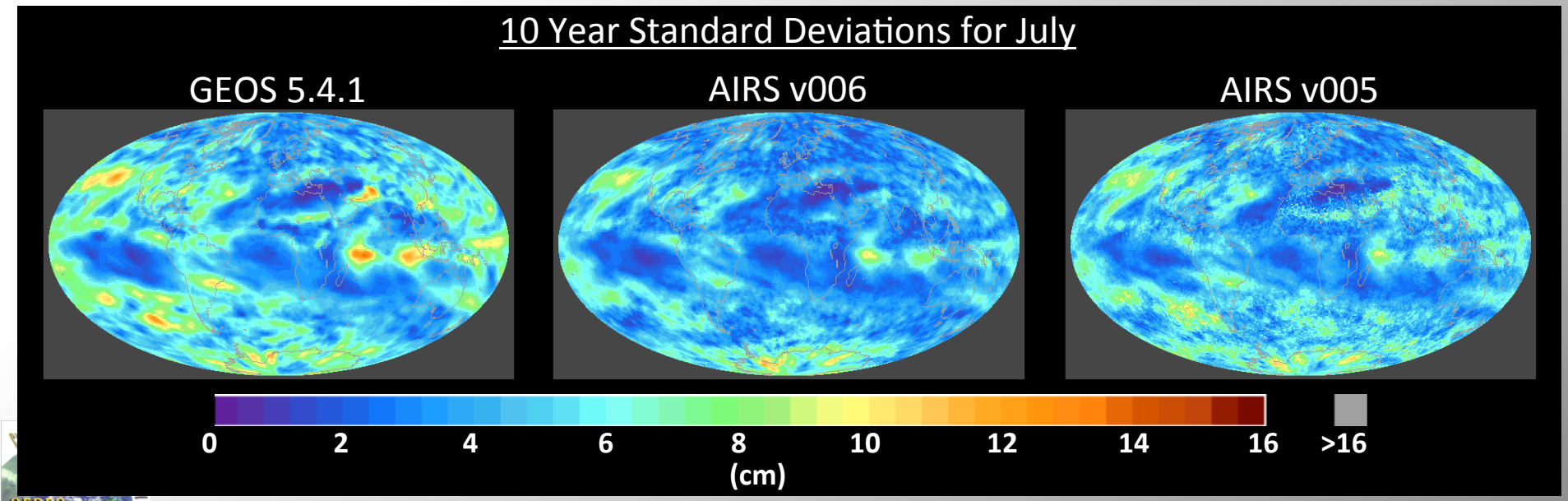
UTRH Differences (%) (January & July)





UTRH Standard Deviations (%) (January & July)





Global mean UTRH 10 year deltas

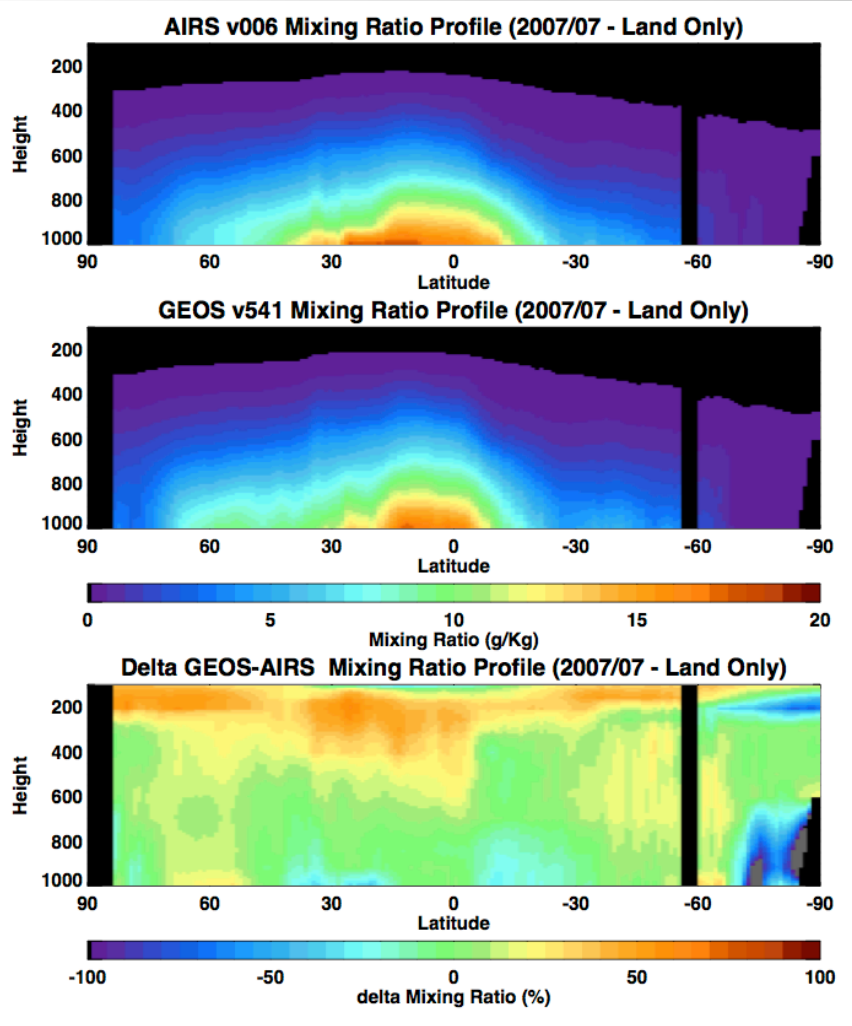
- In Jan & Jul MOA shows more UTRH over ITCZ and storm tracks than AIRS v005(6).
- Mid-latitude oceans fair better.

Global mean UTRH 10 year std deviations

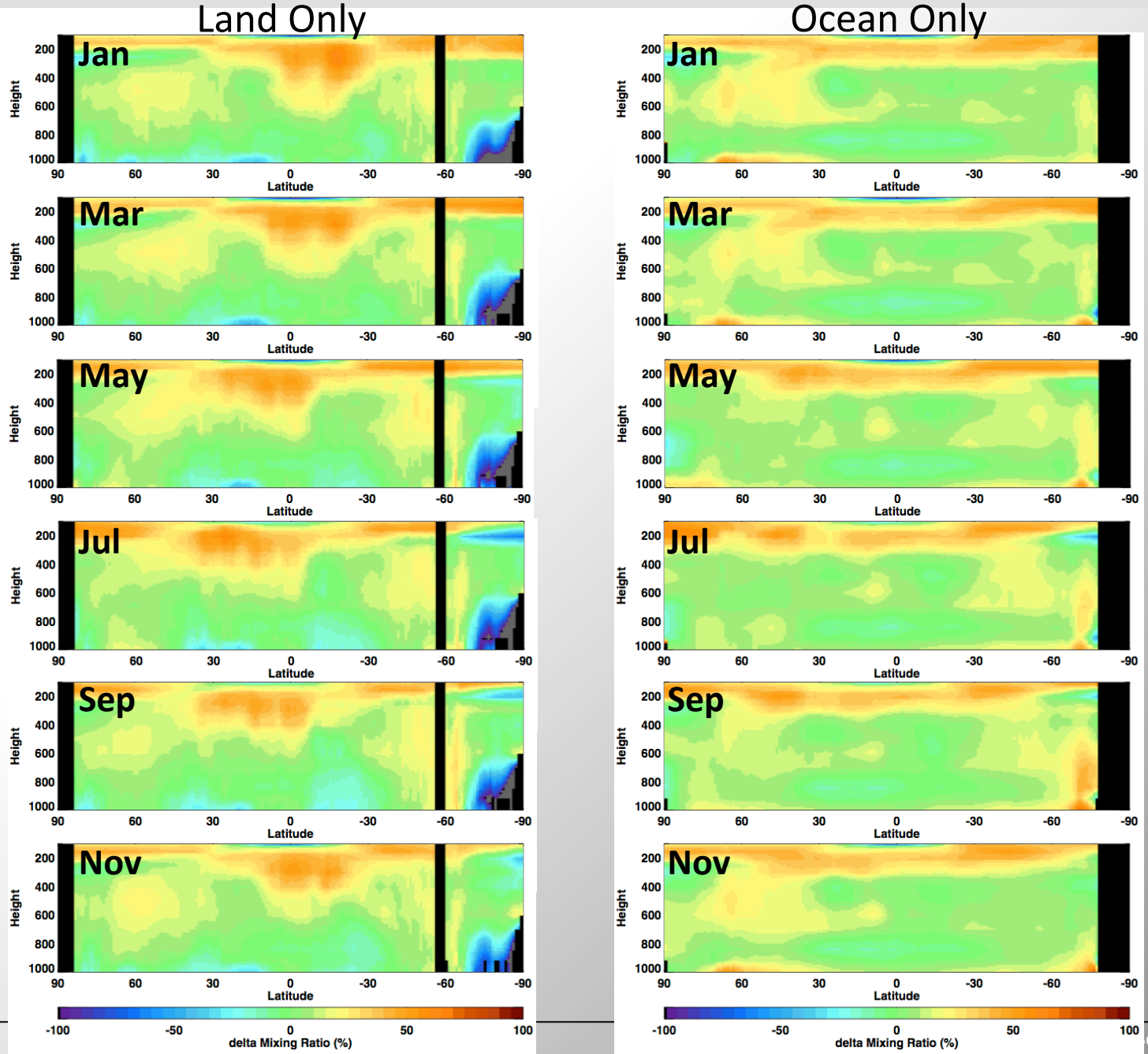
- Locations of interannual variability in UTRH agree but MOA magnitude of variance is larger.
- True for both Jan & Jul.

Zonal Mean/Height Difference in Temperature & Mixing Ratio

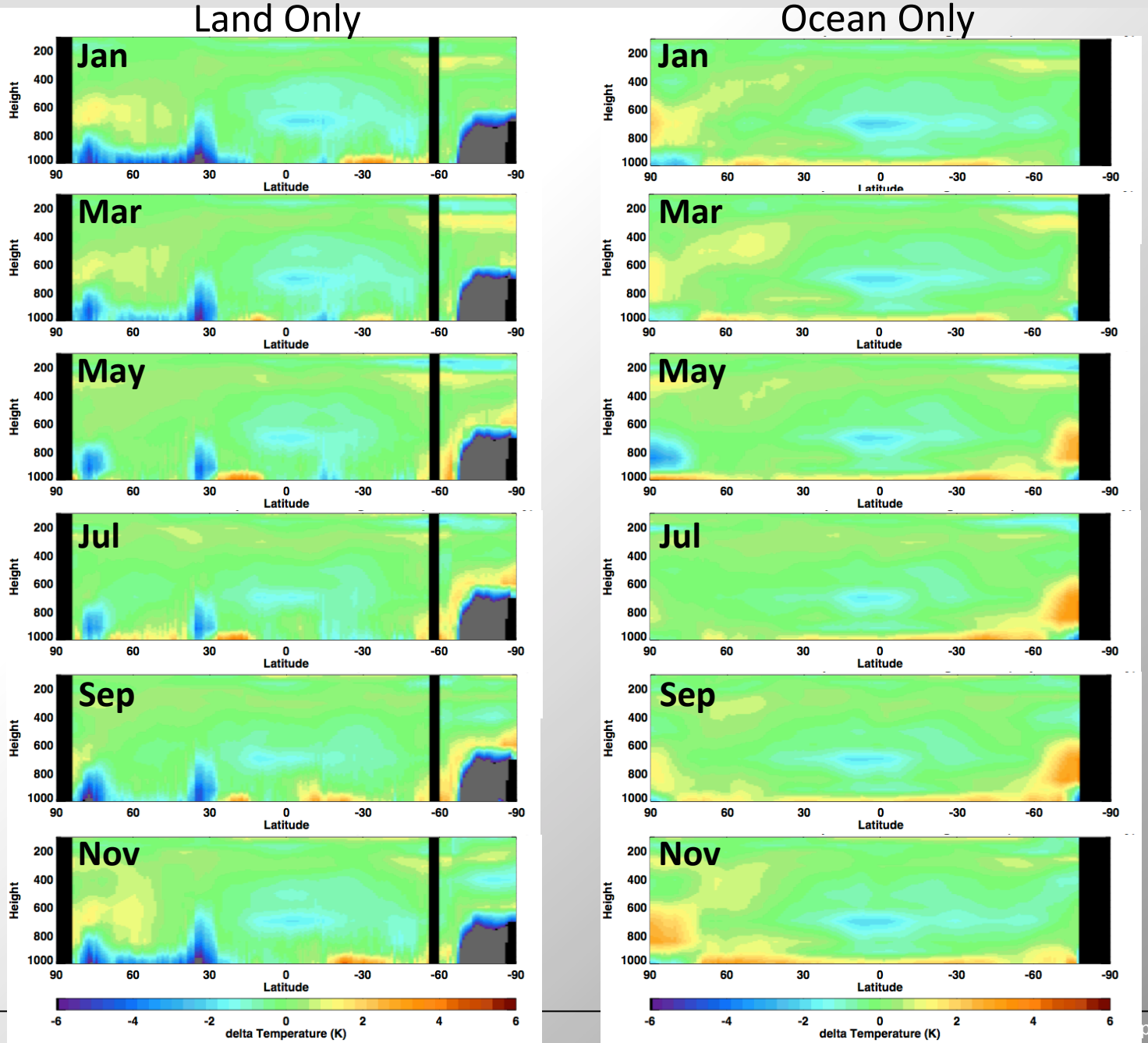
Calculate zonal mean 10 year averages
Separate zonal means by land & ocean.
Show differences (MOA/GEOS – AIRS) across the year.



Zonal Mean Mixing Ratio Difference (MOA/GEOS-AIRv006) 10 Year Avg



Zonal Mean Temperature (MOA/GEOS-AIRv006) 10 Year Average



Zonal Mean Temperature Differences

Differences in near surface temperatures are minimal over oceans but larger over land (MOA/GEOS < AIRS v006).

Over land

- Persistent low bias MOA<AIRS over NH Greenland & Himalayas
- Small negative bias over tropical middle troposphere for all months.
- Seasonal change in bias over NH continents ~40N to 70N
- Antarctic: warm bias in lowest part of atmosphere (SH winter) , cold bias near the surface all seasons

Over Ocean

-Same tropical middle troposphere cold bias.
-Warm bias between 60S to 70S between 800 & 600mb, with cold near the surface.

Conclusions

Large drop in UTRH from GEOS 4 to GEOS 5.2.

UTRH is higher in GEOS 4/5.2/5.4.1 than AIRS by ~15% for whole length of record.

Found primarily over continents and storm tracks.

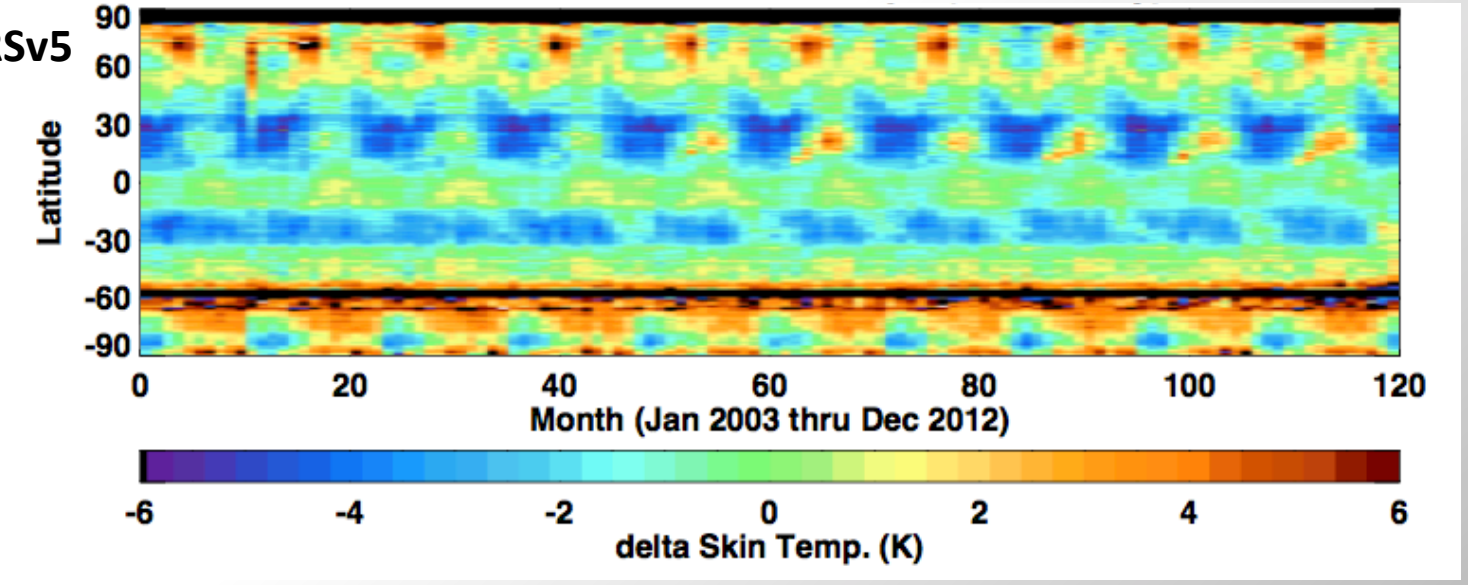
AIRS v005 deteriorates after the fall of 2011 (perhaps sooner over deserts).

Processing in EBAF switches from v005 to v006 in Oct 2011.

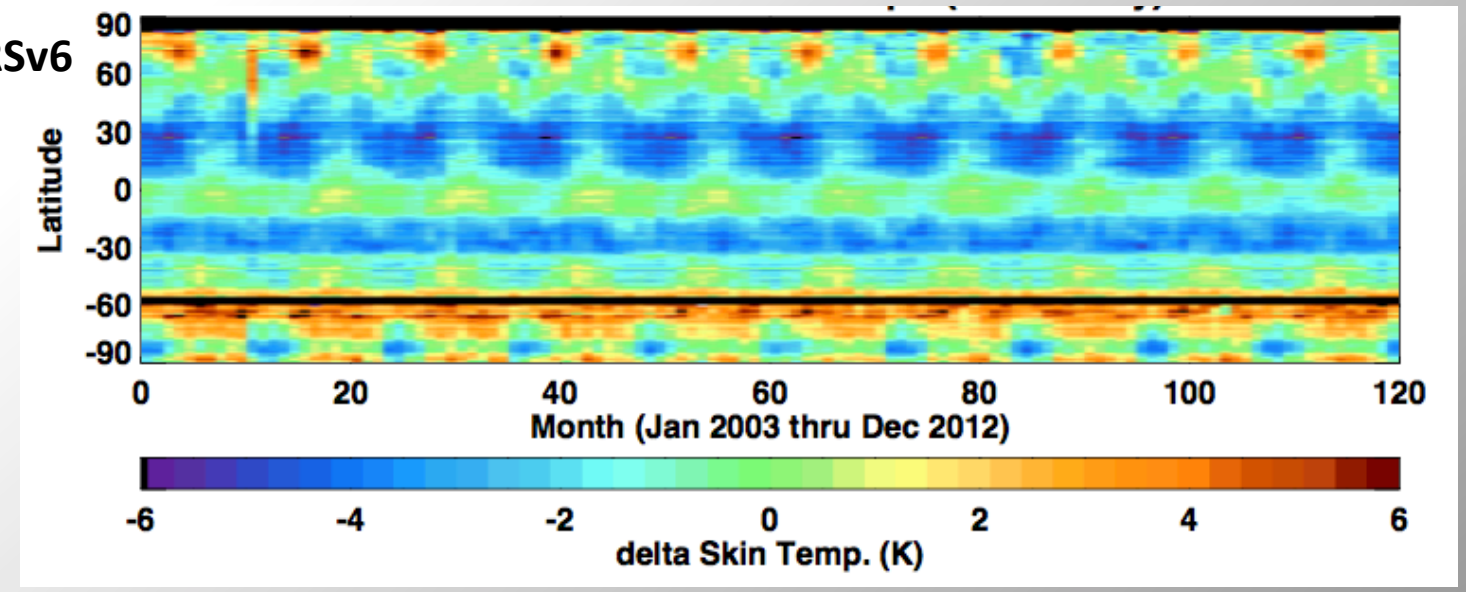
Differences in near surface temperatures are minimal over oceans but larger over land.

Zonal Mean Skin Temp Difference (Jan 2003 to Dec 2012)
Deseasonalized Hovmoller Diagrams

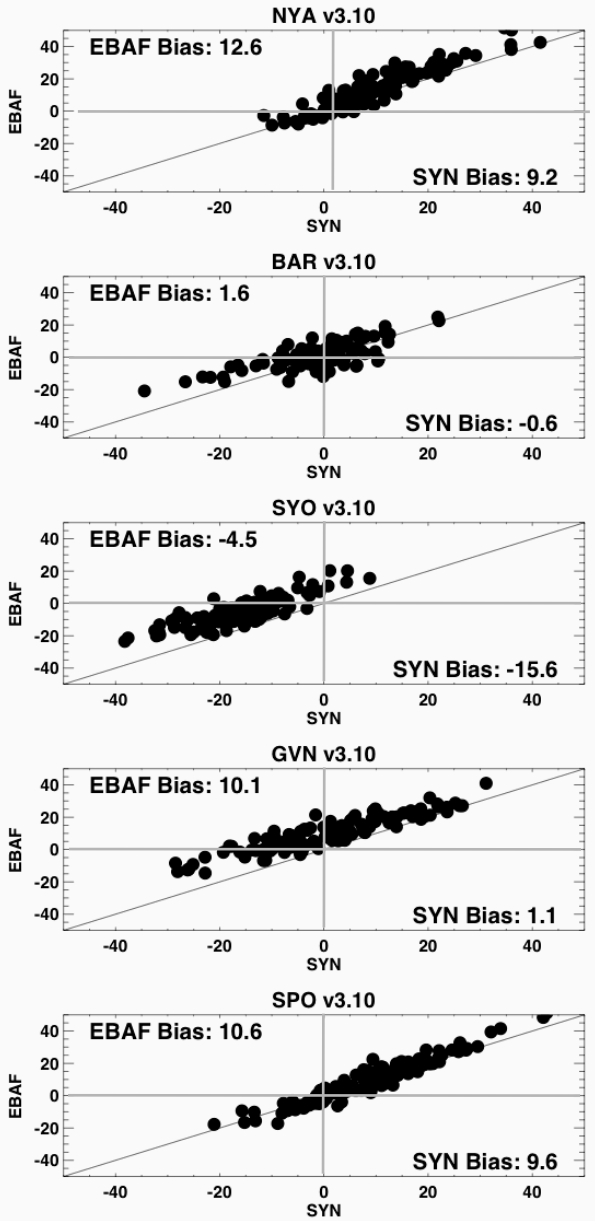
MOA-AIRSv5



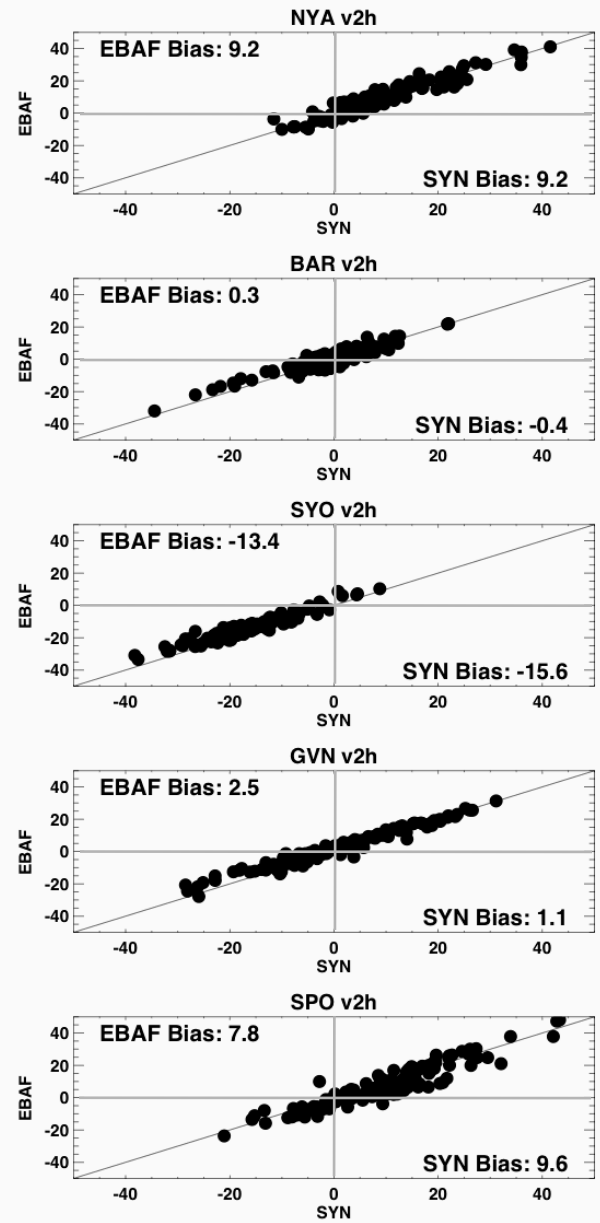
MOA-AIRSv6



With AIRS to Poles



With AIRS to +/-60



12.6	9.2
1.6	0.3
-4.5	-13.4
10.1	2.5
10.6	7.8
6.1	1.3