



# AMSR-E Geolocation and Resampling 6.9 and 10.7 GHz Channels: Implications for Applications

Frank Wentz and Marty Brewer  
Remote Sensing Systems, Santa Rosa, CA

- **Geolocation Review**
- **Sensor-to-Spacecraft Roll of  $.09^\circ$  -> use Earth\_Incidence over water**
- **10.7 (not-resampled) geolocation errors: ~2 km -> use resampled TBs**
- **6.9 (not-resampled) geolocation errors: ~4 km -> use resampled TBs**
- **10.7 GHz RFI -> Geostationary\_Satellite\_Glint\_Angle**

Joint AMSR Science Team Meeting  
La Jolla, CA, September 6-8, 2006



## Ground Truth: Coastlines

- Stable, well known locations (with a few exceptions, e.g. Aral Sea)
- High contrast, large diff's in brightness temps from land to water

## Methodology:

- Iteratively tweak geometric parameters to achieve coastal alignment  
Repeat: "better or worse" until: proper alignment

## Three Independent Comparisons:

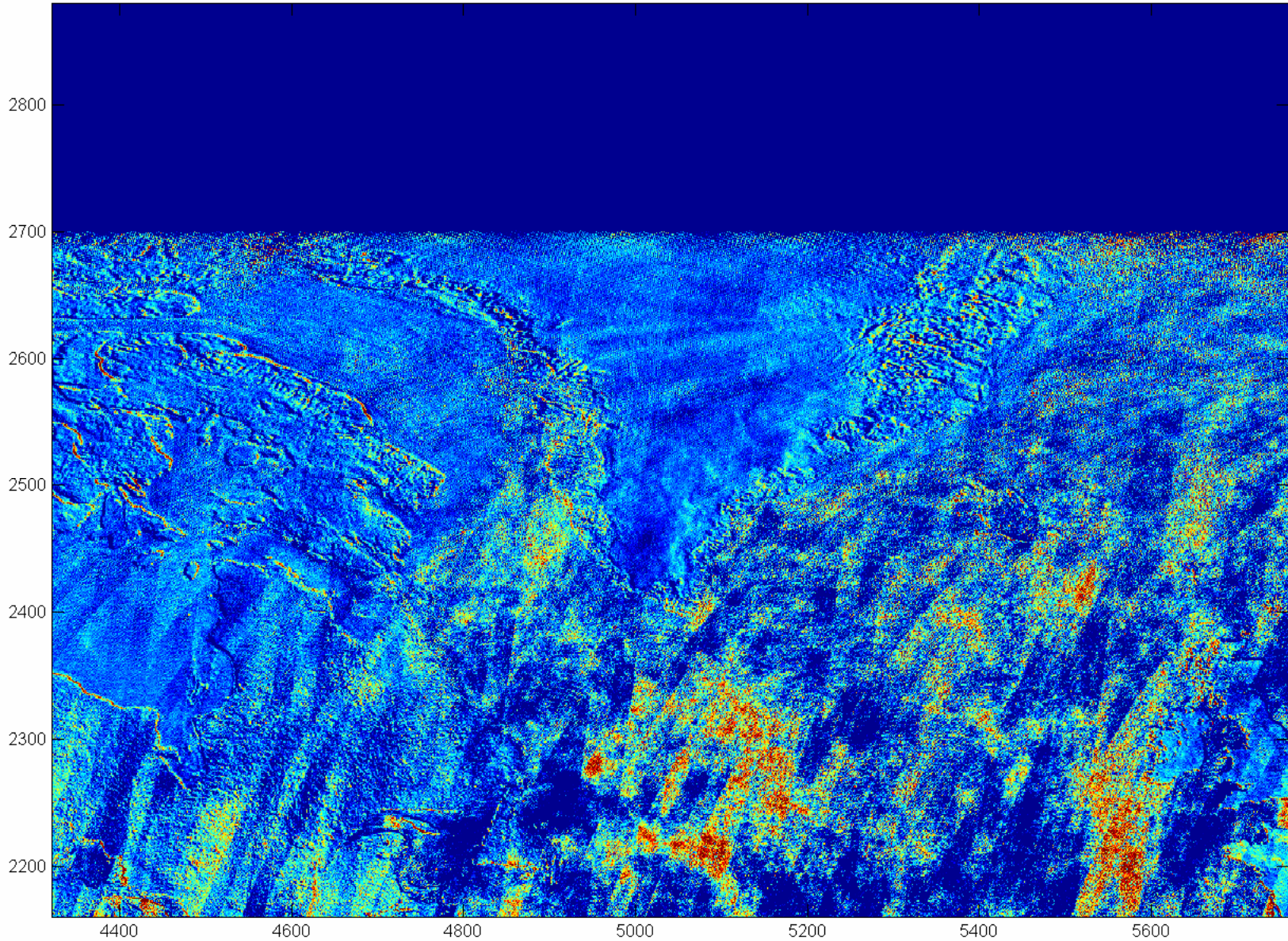
- Global, (left side of swath - right side of swath) differences
- Global, (ascending - descending) swath differences
- Local, direct comparison to Matlab high resolution coastal maps

## Confidence:

- All 3 comparisons yield nearly the same geometric parameters
- Accuracy between 1 and 2 km

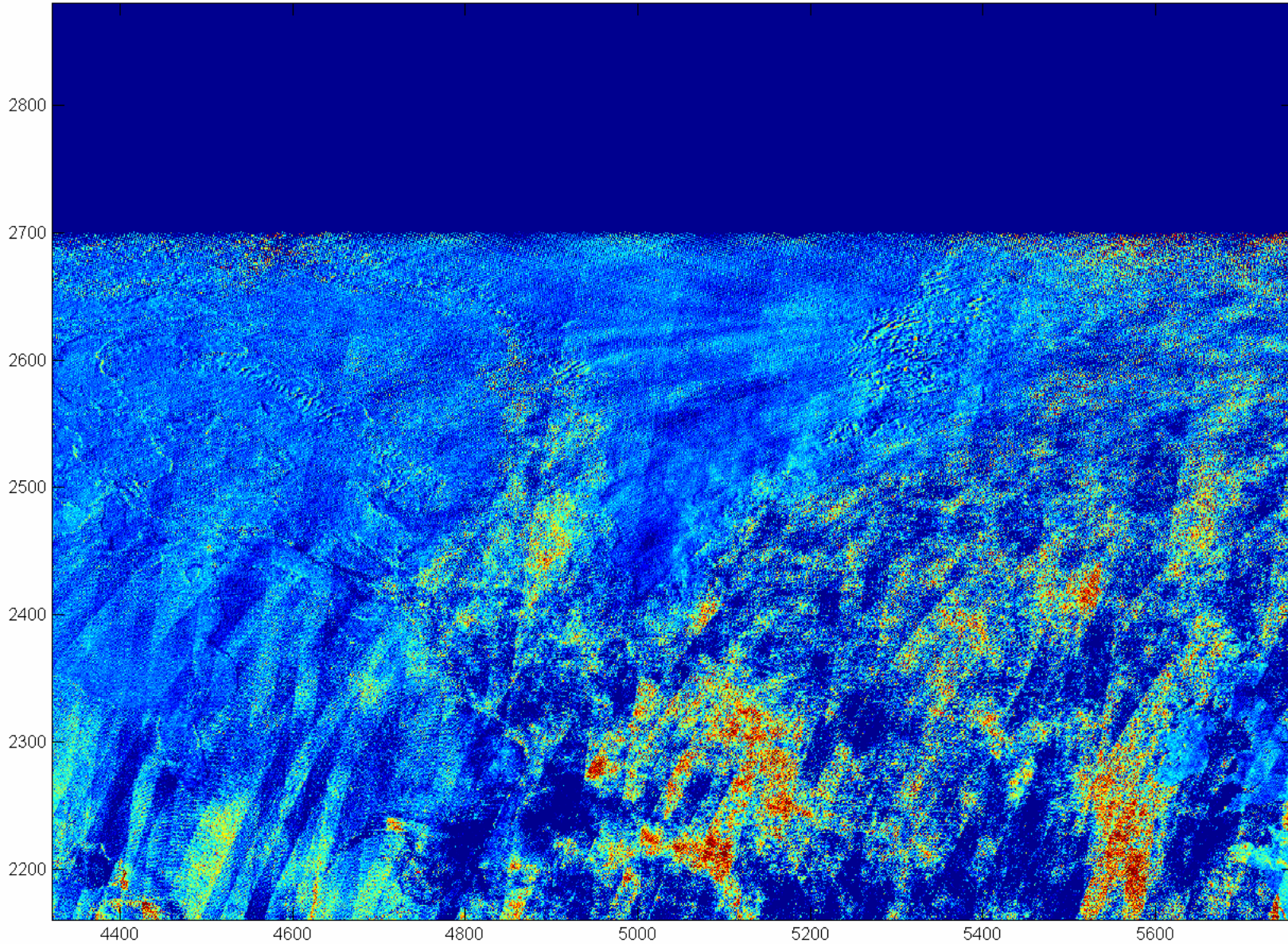


## 89A, left minus right, before



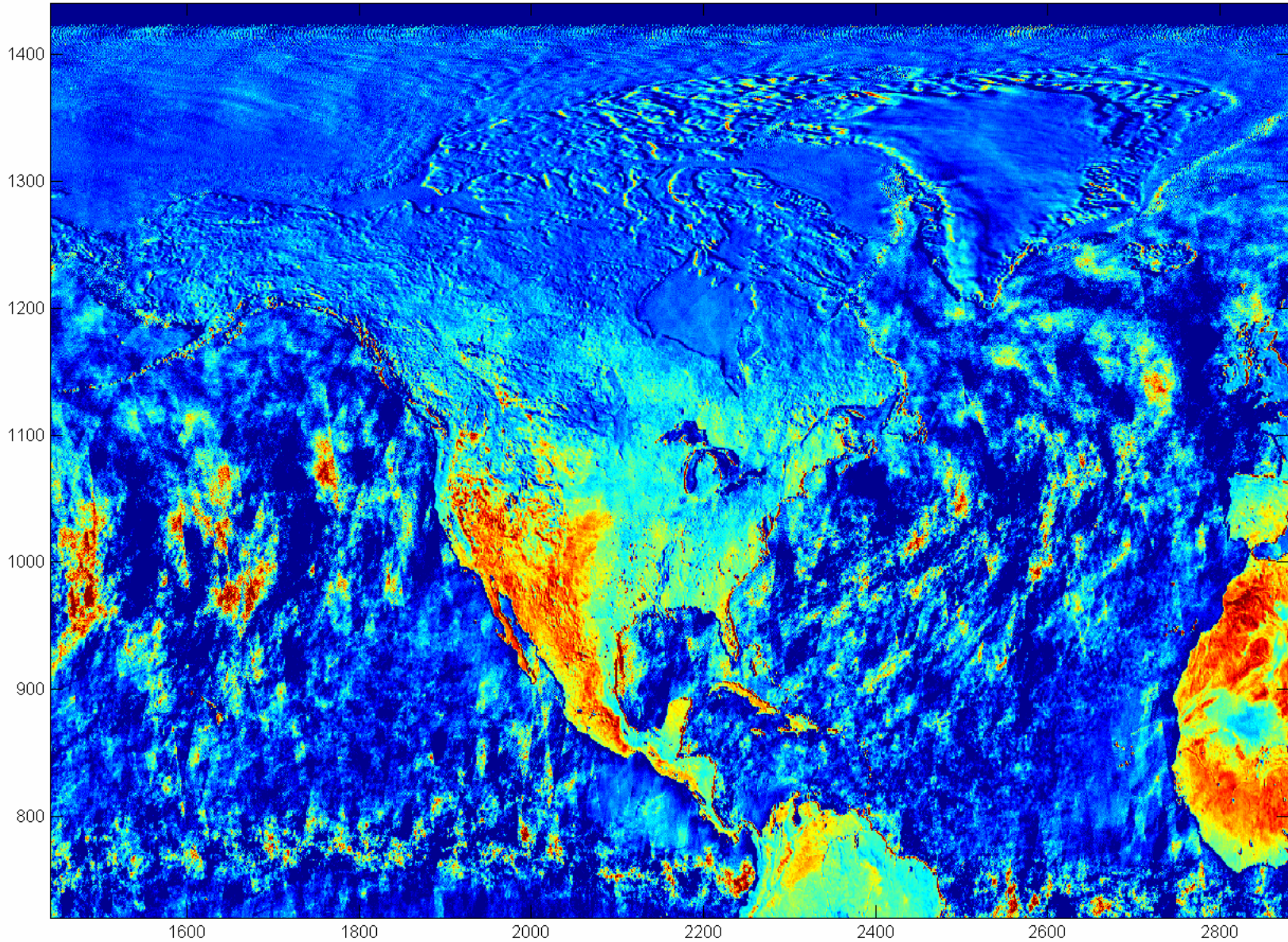


## 89A, left minus right, after



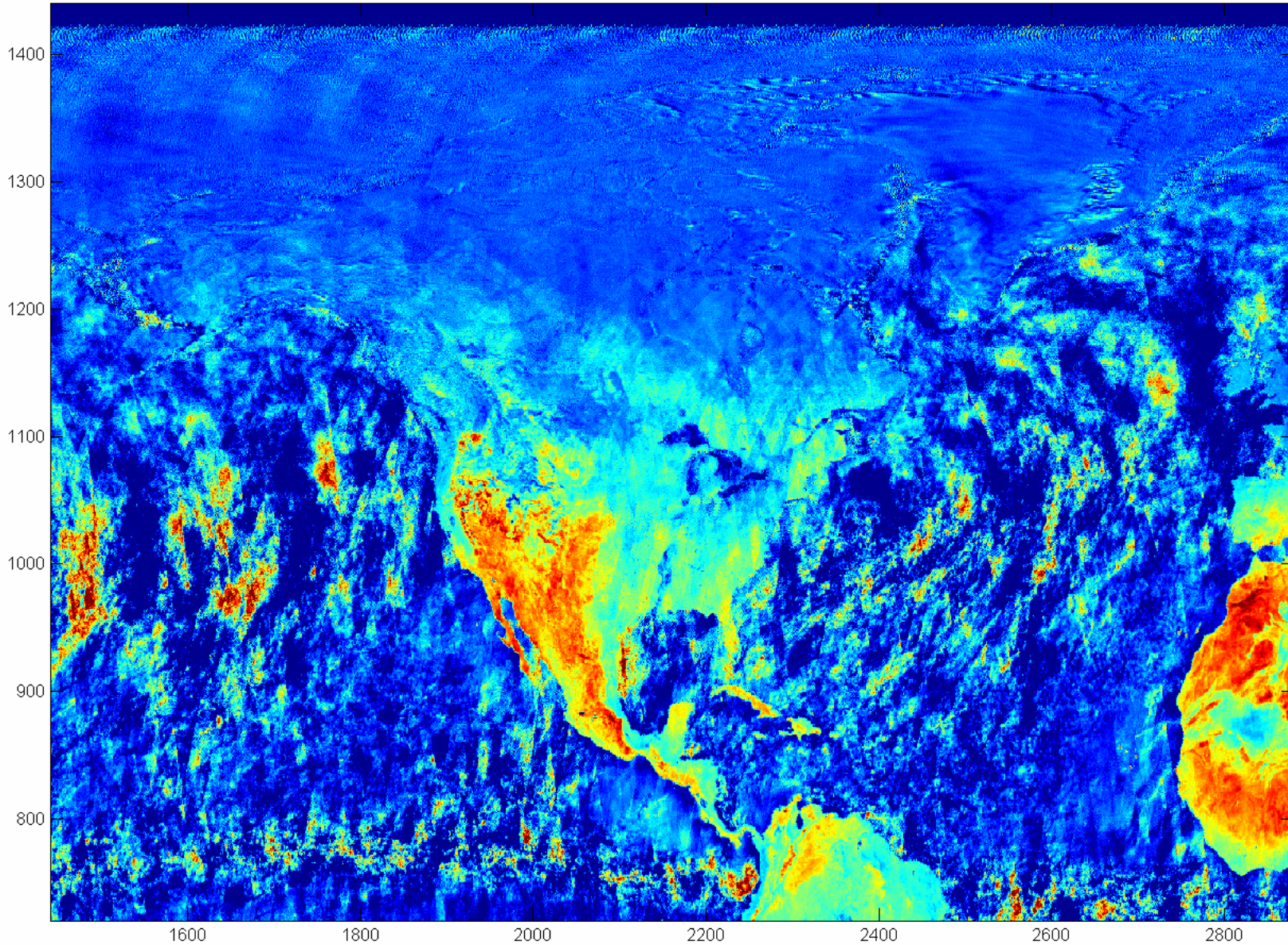


# 37H, ascending minus descending, before





# 37H, ascending minus descending, after

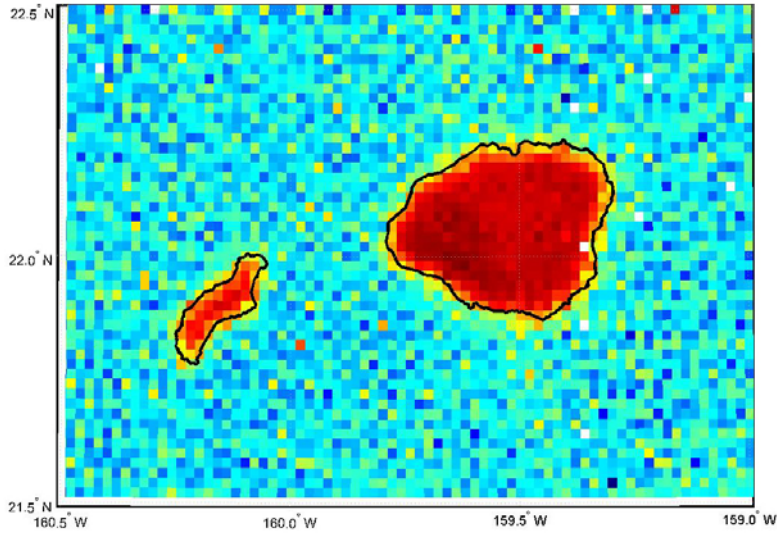




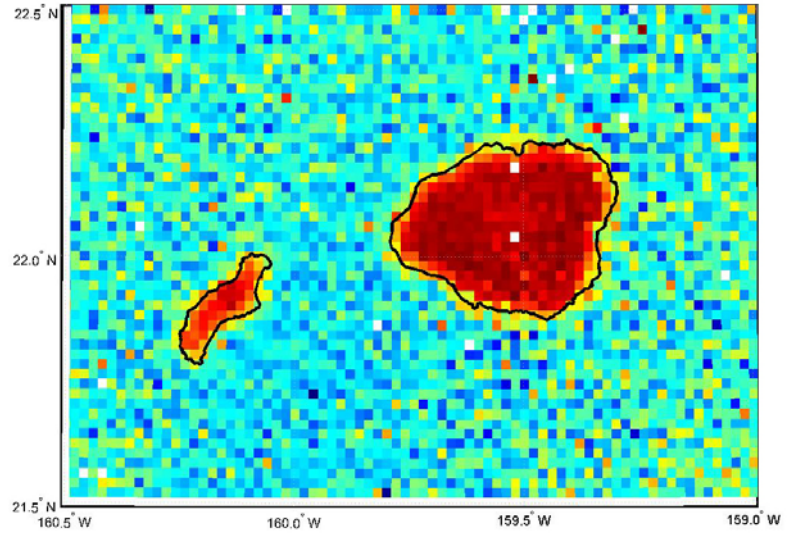
# 89 GHz Ascending/Descending, 2 Months



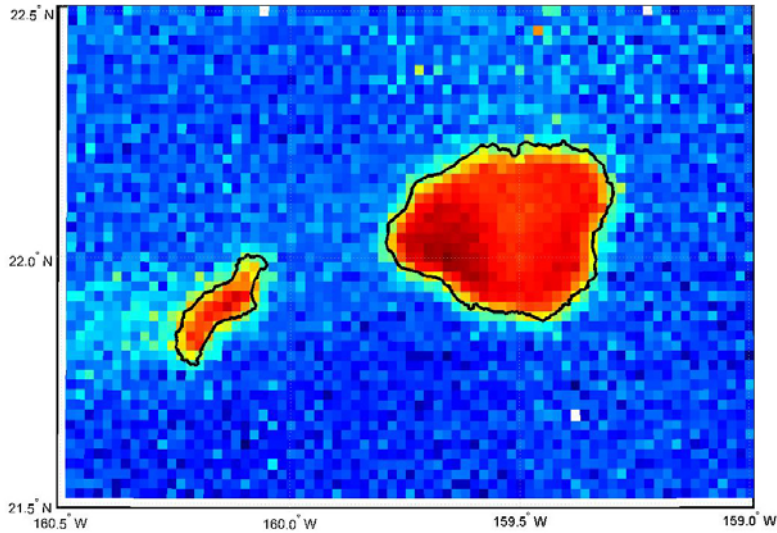
Ascending January Chan 14 combined times cone=47.57, azim=-0.37, roll=0.09



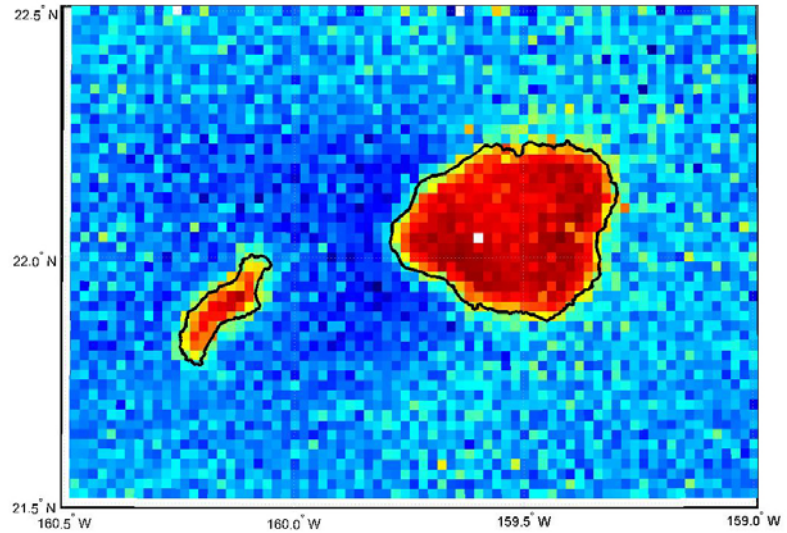
Descending January Chan 14 combined times cone=47.57, azim=-0.37, roll=0.09



Ascending July Chan 14 combined times cone=47.57, azim=-0.37, roll=0.09



Descending July Chan 14 combined times cone=47.57, azim=-0.37, roll=0.09





## Sensor-to-Spacecraft Roll

- .09 degrees (~"tenth of a degree")
- Earth incidence angle affected by roll; varies more than thought

## Per Channel Alignment:

- Separate geolocation analysis for each of 14 channels
- For each frequency, V and H are well aligned
- 89A and 89B align as expected; have their own lats, lons
- 19, 24, and 37 GHz channels are well aligned with each other
- 7 and 11 GHz horn pointing errors:
  - 11 GHz offset by ~2.3 km
  - 7 GHz offset by ~3.9 km





# Sensor-to-Spacecraft Roll: Implications



## First Corrected L2A Version B02 (November, 2004)

- Along scan (cross swath) bias detected and removed
- Earth incidence not as well known then; correction improved calibration

## Improved Correction L2A version B05 (August, 2005)

- Along scan bias due to sensor-to-spacecraft roll no longer removed
- L2A brightness temps represent what the instrument sees on Earth:

Earth incidence angles vary along scan

Ocean brightness temps vary along scan

- Earth incidence angle is computed and included in L2A:

Low\_Res\_Swath : Data Fields : Earth\_Incidence

## Implication:

- Use Earth\_Incidence



# Sensor-to-Spacecraft Roll: Implications



The screenshot shows the HDF Browser application window. The title bar reads "HDF Browser - [AMSR\_E\_L2A\_BrightnessTemperatures\_ZZ\_200605012307\_D.h...". The menu bar includes "File", "Edit", "Palettes", "Window", and "Help". Below the menu bar is a toolbar with icons for home, folder, print, and help. The main area has two tabs: "Normal" (selected) and "Detail". A tree view on the left shows the following structure:

- Low\_Res\_Swath (checked)
  - Geolocation Fields (checked)
  - Data Fields (checked)
    - Antenna\_Temp\_Coefficients\_6\_to\_52
    - Data\_Quality
    - SPS\_Temperature\_Count
    - Interpolation\_Flag\_6\_to\_52
    - Observation\_Supplement
    - Position\_in\_Orbit
    - Navigation\_Data
    - Attitude\_Data
    - SPC\_Temperature\_Count
    - Earth\_Incidence** (highlighted)
    - Earth\_Azimuth
    - Sun\_Elevation
    - Sun\_Azimuth

A red rounded rectangle with the text "Earth\_Incidence" is overlaid on the right side of the screenshot, corresponding to the highlighted item in the tree view. The status bar at the bottom left shows "Ready".



# Channels 7, 11 Misalignment: Implications



## Corrected via Resampling

- Beginning with L2A version B07 (March, 2006)
- Newly derived resampling weights to recenter 7, 11 footprints
- Channels 7, 11 are resampled to match the center point of 19-24-37

## Previously Reasonable:

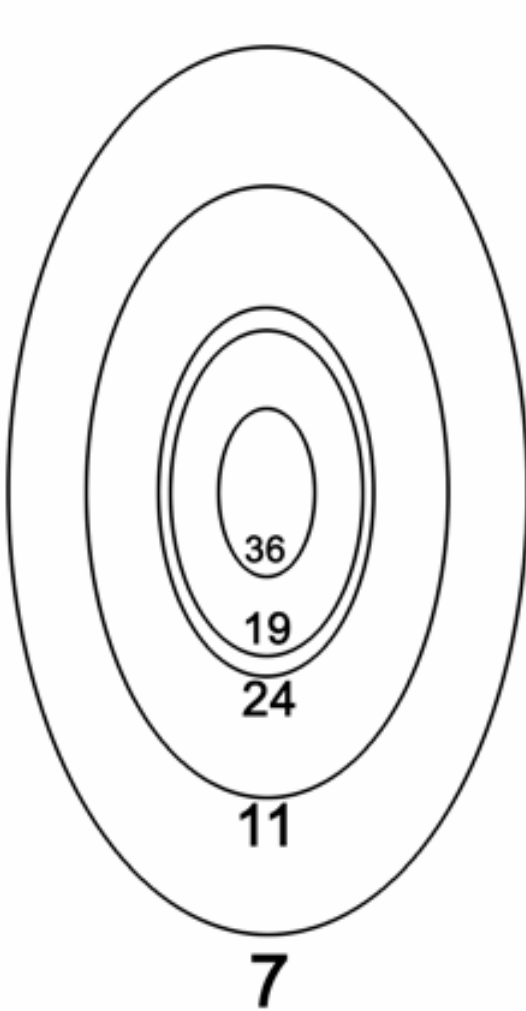
- Compare native 7 to channels resampled to match 7 footprint (Res.1)
- Compare native 11 to channels resampled to match 11 footprint (Res.2)

## Now Recommended:

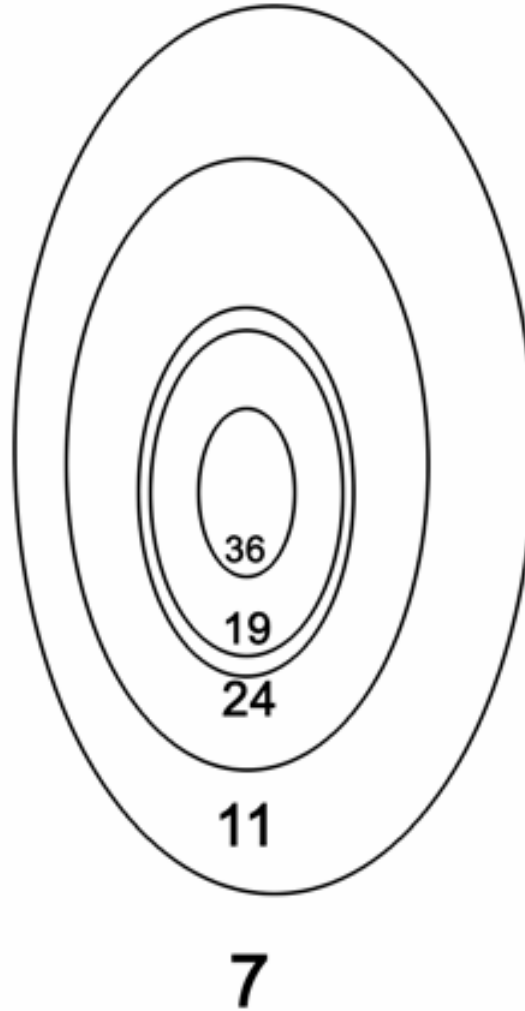
- Use resampled 7, especially when using other resampled channels
- Use resampled 11, especially when using other resampled channels



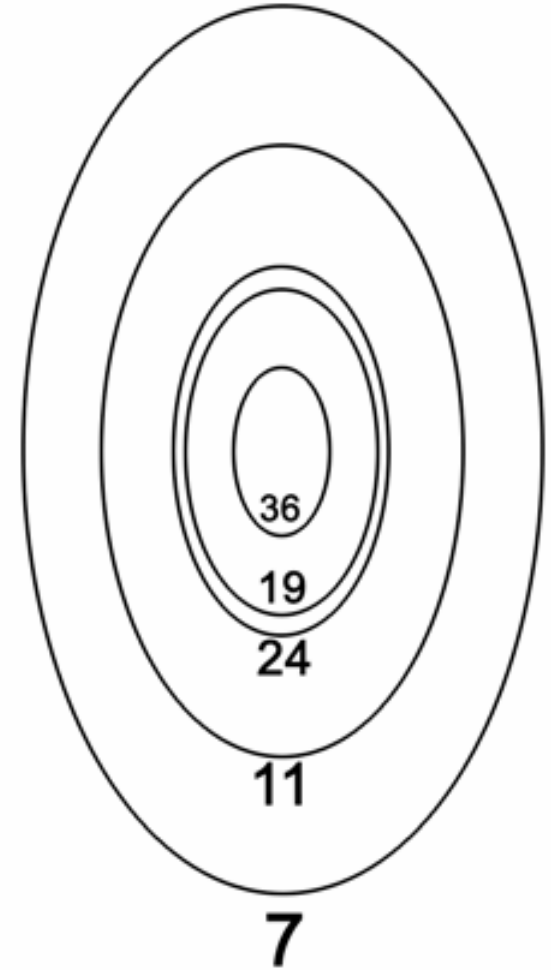
# Channels 7, 11 Misalignment



Expected



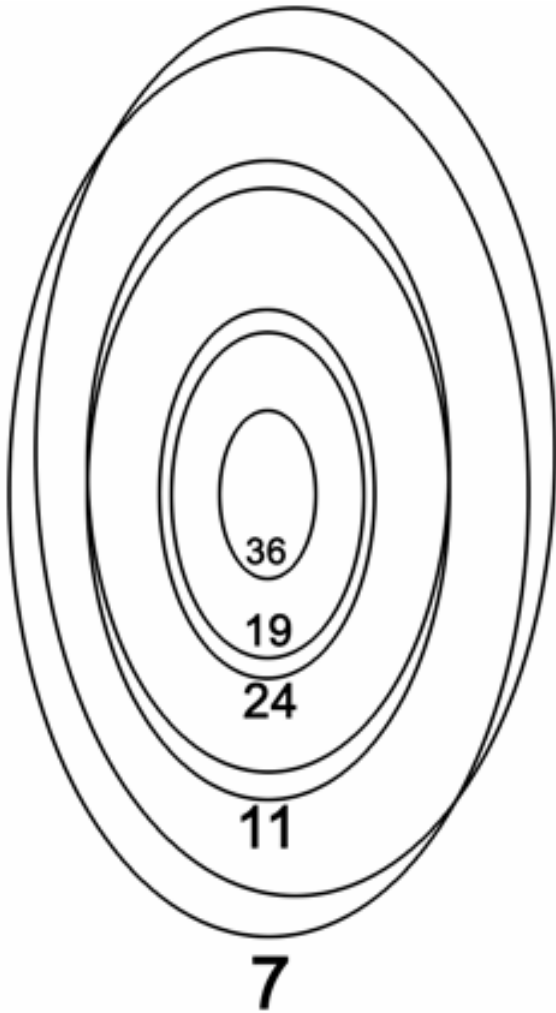
Discovered



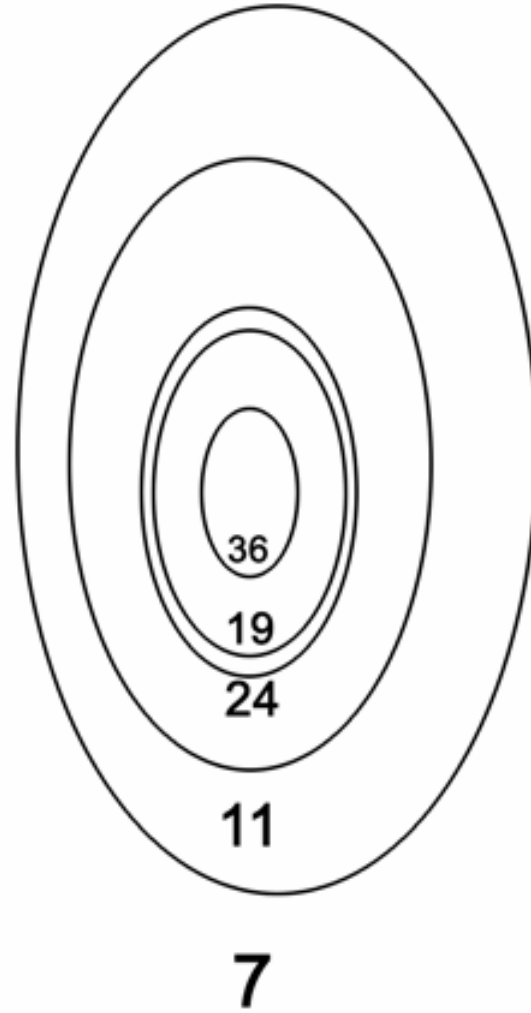
Resampled



# Channels 7, 11 Misalignment



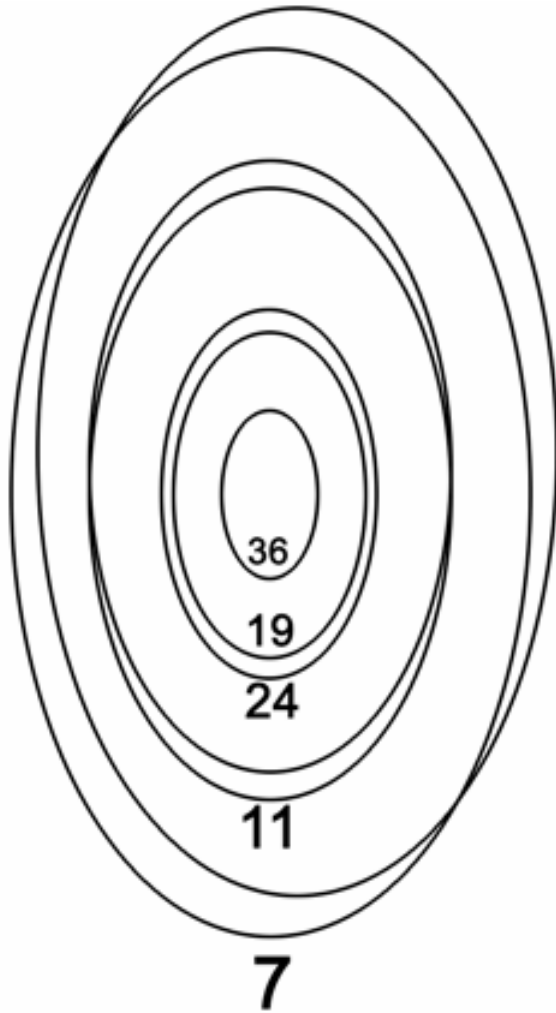
Both



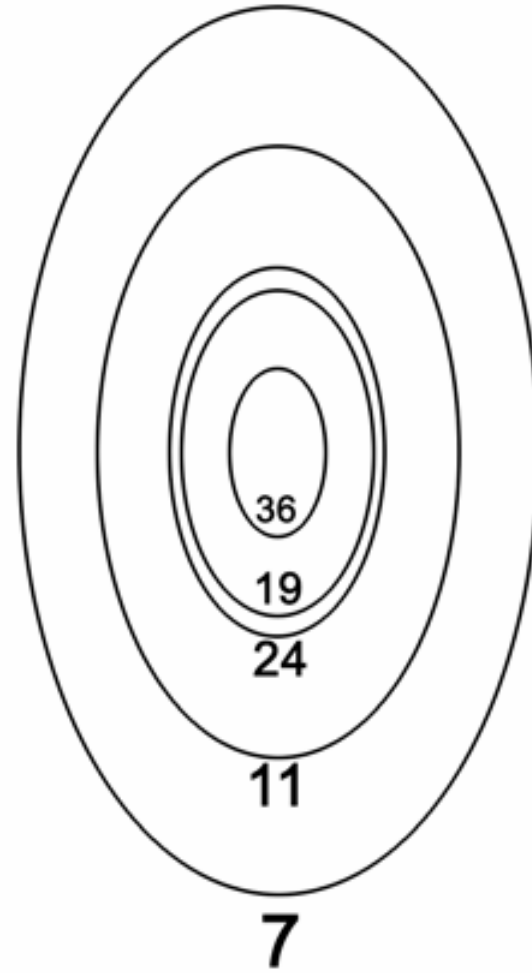
Not Resampled



# Channels 7, 11 Misalignment



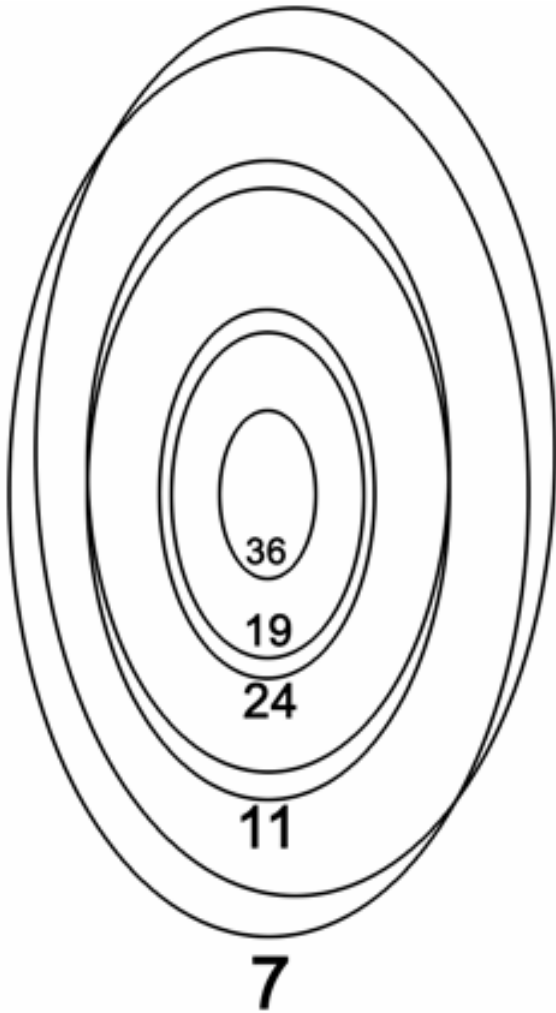
Both



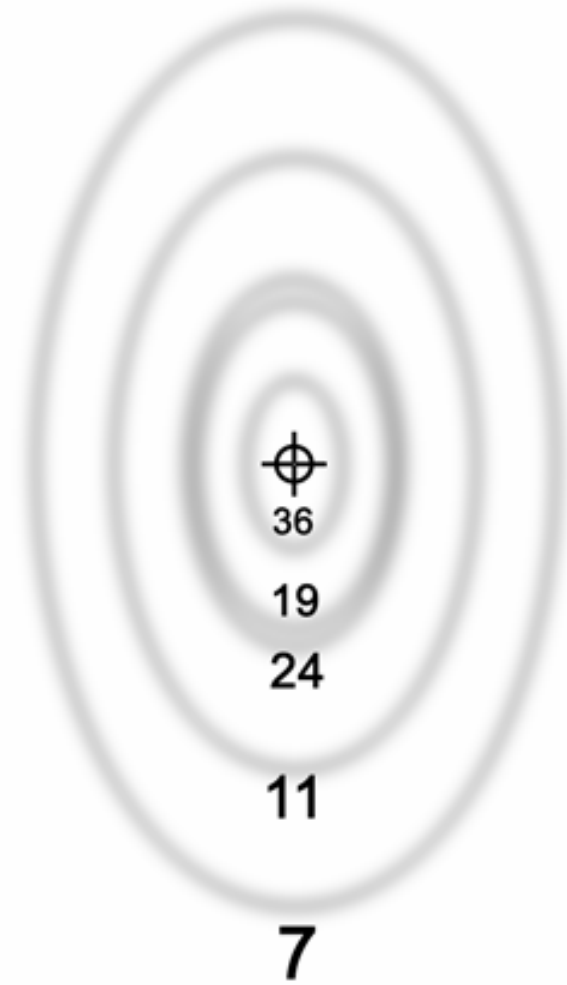
Resampled



# Channels 7, 11 Misalignment



Both



Resampled



# Channels 7, 11 Misalignment:



The screenshot shows the HDF Browser interface with a file named [AMSR\_E\_L2A\_BrightnessTemperatures\_ZZ\_200605012307\_D.hdf]. The channel list is divided into two sections:

- Yellow section (Not-resampled channels):**
  - Hot\_Load\_Count\_6\_to\_52
  - 6.9V\_Res.1\_TB\_(not-resampled)
  - 6.9H\_Res.1\_TB\_(not-resampled)
  - 10.7V\_Res.2\_TB\_(not-resampled)
  - 10.7H\_Res.2\_TB\_(not-resampled)
  - 18.7V\_Res.3\_TB\_(not-resampled)
  - 18.7H\_Res.3\_TB\_(not-resampled)
  - 23.8V\_Approx.\_Res.3\_TB\_(not-resampled)
  - 23.8H\_Approx.\_Res.3\_TB\_(not-resampled)
  - 36.5V\_Res.4\_TB\_(not-resampled)
  - 36.5H\_Res.4\_TB\_(not-resampled)
- Green section (Resampled channels):**
  - 6.9V\_Res.1\_TB
  - 6.9H\_Res.1\_TB
  - 10.7V\_Res.1\_TB
  - 10.7H\_Res.1\_TB
  - 10.7V\_Res.2\_TB
  - 10.7H\_Res.2\_TB
  - 18.7V\_Res.1\_TB

A large black bracket and a thumbs-up icon are positioned to the right of the green section, indicating that these channels are correctly aligned. A black arrow points from the yellow section to a red caution box on the right.

**Caution:**  
7, 11 (not-resampled)  
do not align with:  
\*resampled Res.1 ( 7)  
\*resampled Res.2 (11)  
\*resampled Res.3 (19)  
\*resampled Res.4 (37)

The status bar at the bottom left shows "Ready".





## Lunar Radiation in Cold Mirror

- Twice per month, the moon (120°-370° K) is seen in AMSR-E cold mirror
- Lunar contributions to cold counts are now removed (corrected)

## Aqua Pitch Error August-September 2003

- Correction improved calibration and Earth\_Incidence
- Corrected with version B05 (August, 2005)

## More Improvements

- See release notes

## Implications:

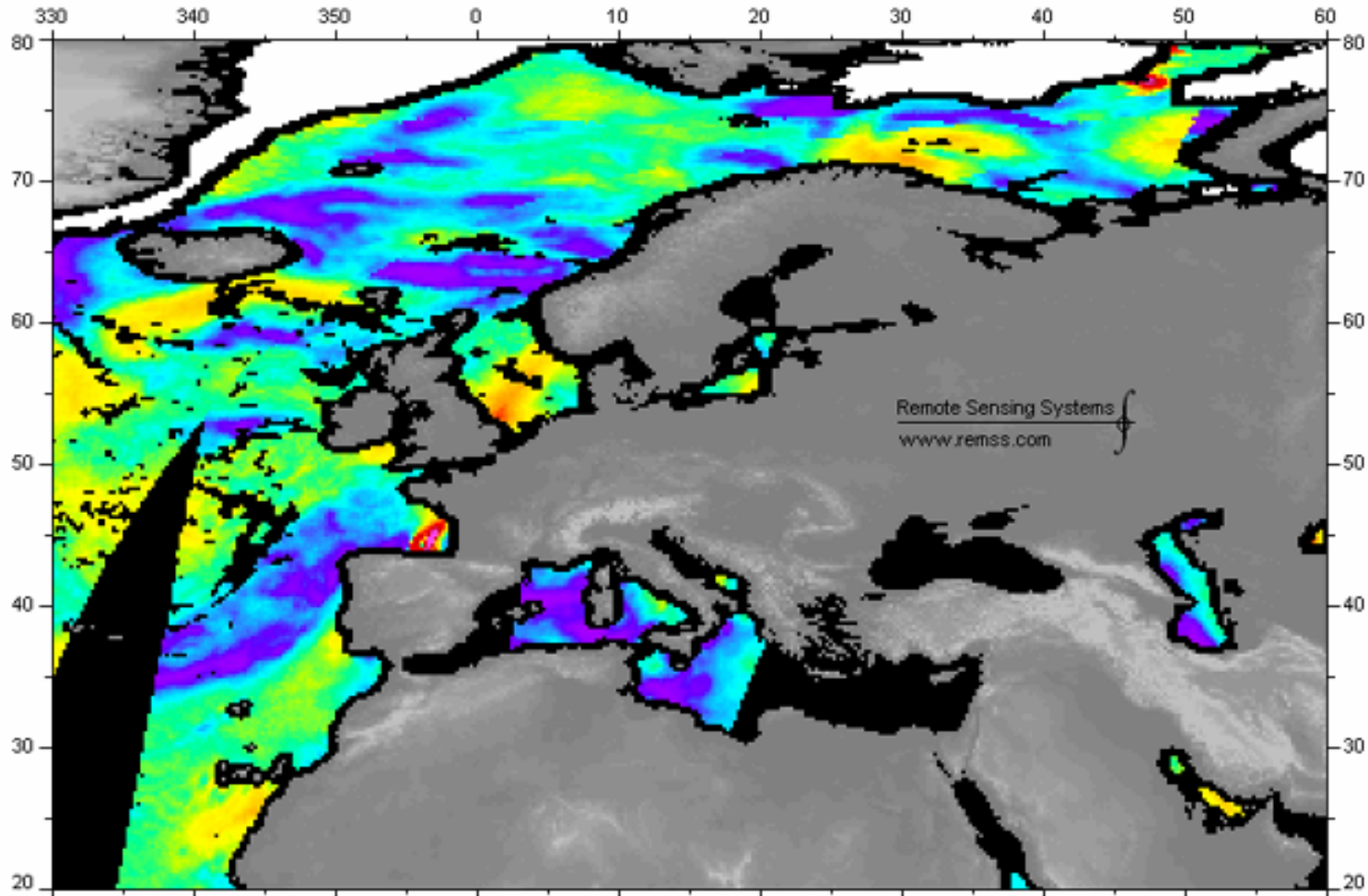
- Use latest L2A when available



# Geostationary RFI @ 10.7 GHz

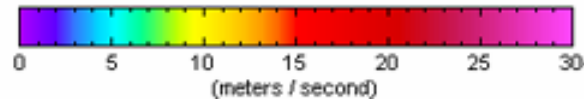


AMSR-E Surface Wind Speed: 2002/06/22 - nighttime passes - European Satellite TV



02:54 UTC

Wind Speed:

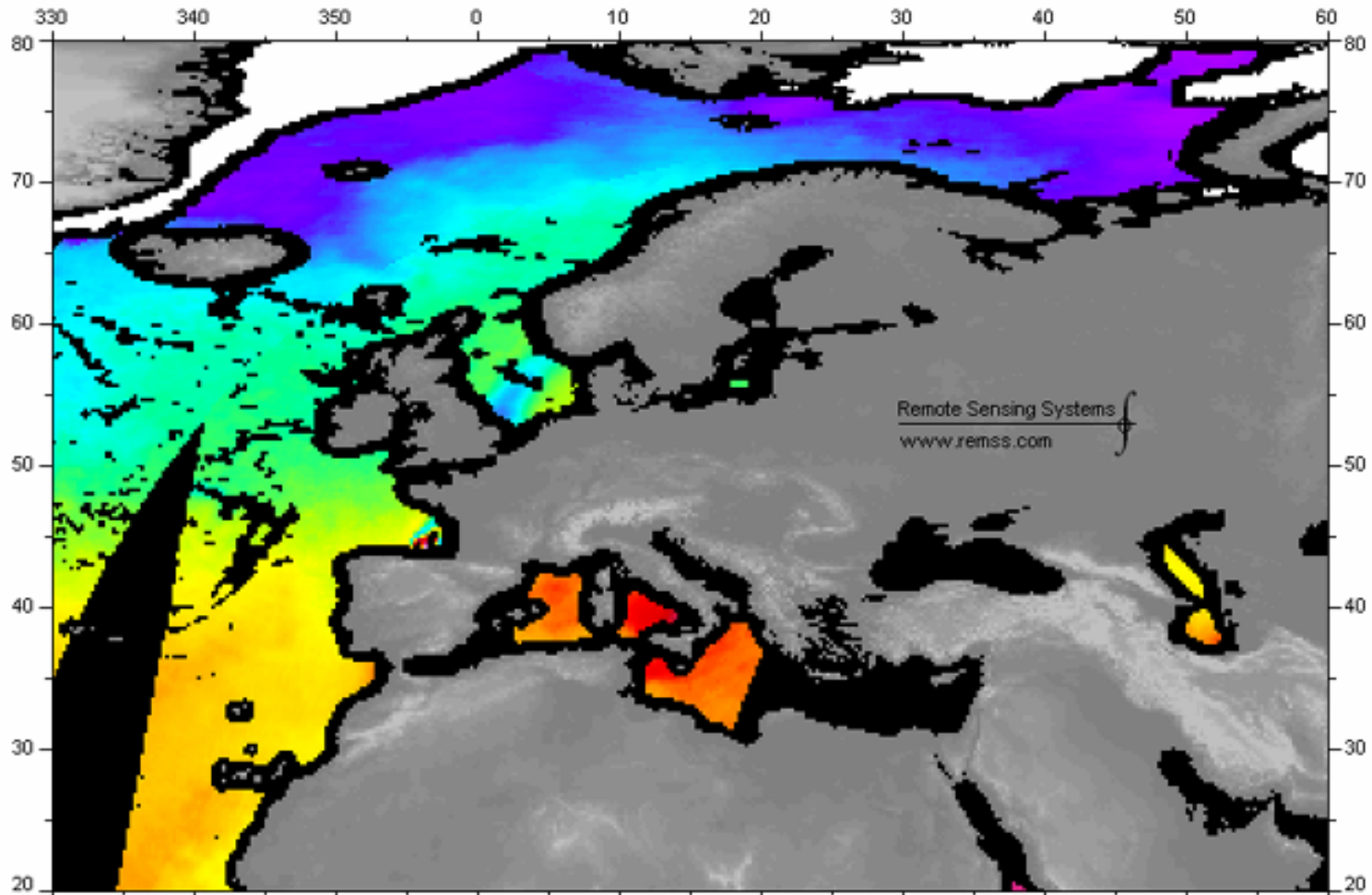




# Geostationary RFI @ 10.7 GHz

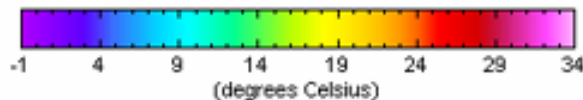


AMSR-E Sea Surface Temperature: 2002/06/22 - nighttime passes - European Satellite TV



02:54 UTC

SST:





# Geostationary RFI @ 10.7 GHz



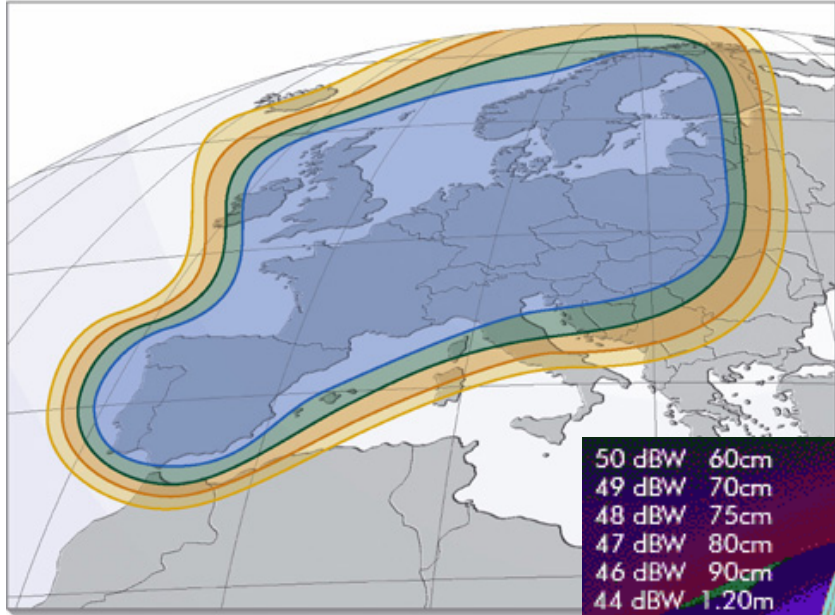
Dish sizes:

60 cm

75 cm

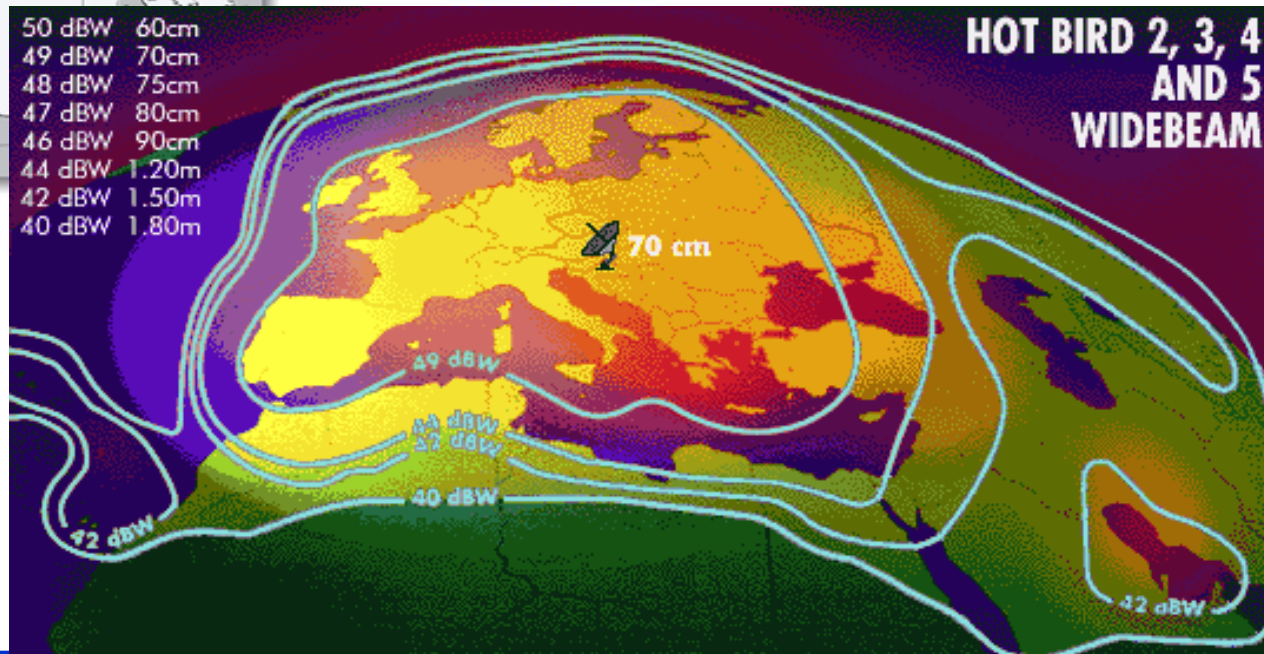
90 cm

120 cm



- ◀ Astra: 19.2° East Longitude  
( RFI from 19° not obvious in eastern Mediterranean; highly consistent with power images shown here. )
- ▼ Hotbird: 13.0° East Longitude

50 dBW	60cm
49 dBW	70cm
48 dBW	75cm
47 dBW	80cm
46 dBW	90cm
44 dBW	1.20m
42 dBW	1.50m
40 dBW	1.80m



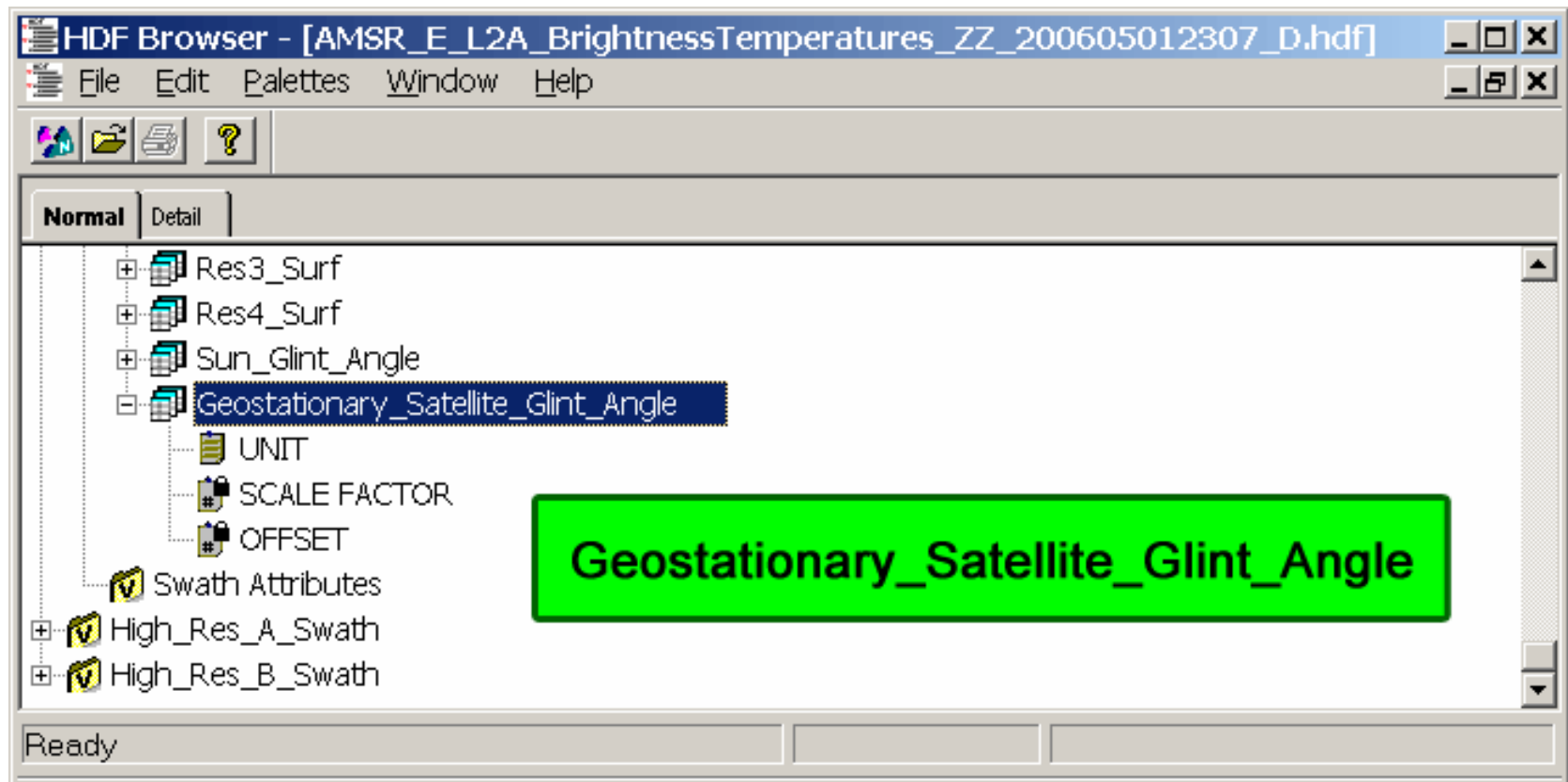
Astra: 19.2° E ▲

Hotbird: 13.0° E ►



## Implemented L2A Version B05 (August, 2005)

- Glint Angles computed to  $13.0^\circ$  and  $19.2^\circ$  E (at geostationary altitude)
- Smallest glint angle included in L2A:





# AMSR-E Geolocation and Resampling 6.9 and 10.7 GHz Channels: Implications for Applications

Frank Wentz and Marty Brewer  
Remote Sensing Systems, Santa Rosa, CA

- **Geolocation Review**
- **Sensor-to-Spacecraft Roll of  $.09^\circ$  -> use Earth\_Incidence over water**
- **10.7 (not-resampled) geolocation errors: ~2 km -> use resampled TBs**
- **6.9 (not-resampled) geolocation errors: ~4 km -> use resampled TBs**
- **10.7 GHz RFI -> Geostationary\_Satellite\_Glint\_Angle**

Joint AMSR Science Team Meeting  
La Jolla, CA, September 6-8, 2006