Direction de la Production

Centre de Météorologie Spatiale

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# *Passive Microwave Protection*

ITSC-14 , Beijing , may 2005

METEO FRANCE

# Contamination around 6 GHz

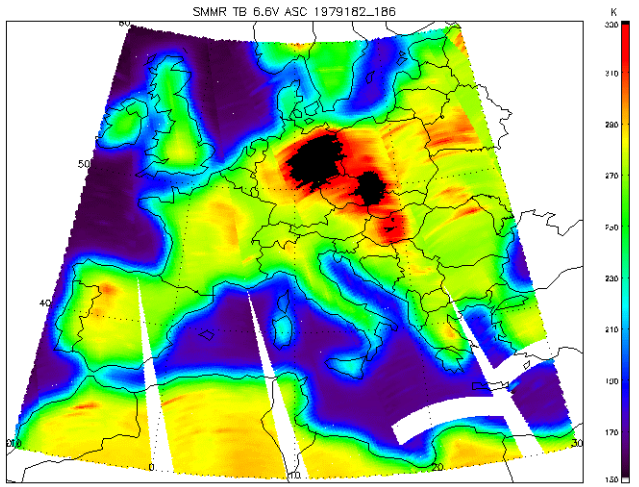
- ***SMMR Data over Europe***
  - **Large area of saturation centered over Berlin area**
    - **Likely originated from tropo-scatter system(s) that are no longer in operation**
    - **Radio link between W. Germany and Berlin**
  - **Many differences in interference regions could be attributable to different observation frequencies of SMMR and AMSR**
    - **Development of radio service occurred from 1987 to 2002**
    - **6.4 – 7.1 GHz Region allocated to Fixed Service (FS) and Mobile Service (MS)**
- ***SMMR Data over North Atlantic*** ***(not shown)***
  - **Investigators noted anomalies in SST retrievals over the North Atlantic using AMSR data**
  - **Up to ~ >20 K perturbations in SST**
  - **Attributed to RFI; not seen in AMSR data**

# Europe at 6 GHz

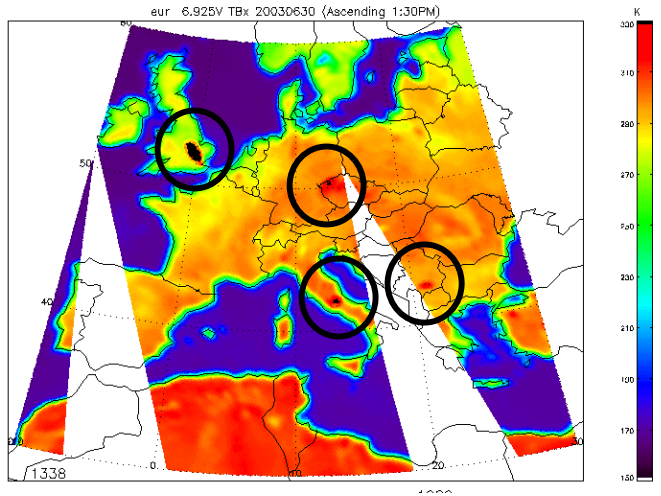
SMMR 6.6 GHz

AMSR-E 6.9 GHz

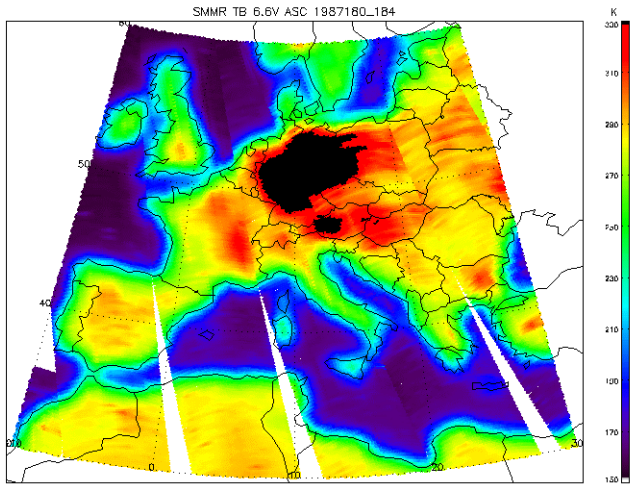
1979




2003




1987

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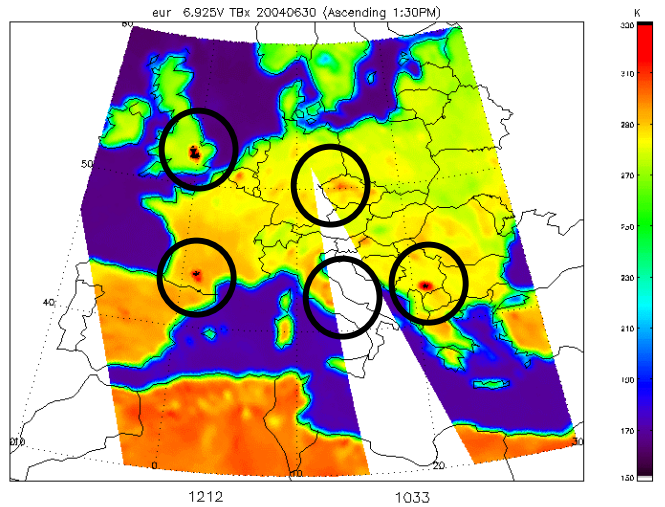
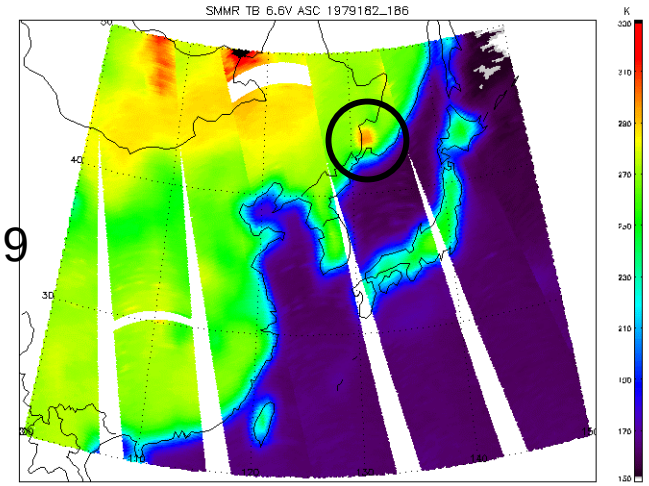


# Far East at 6 GHz

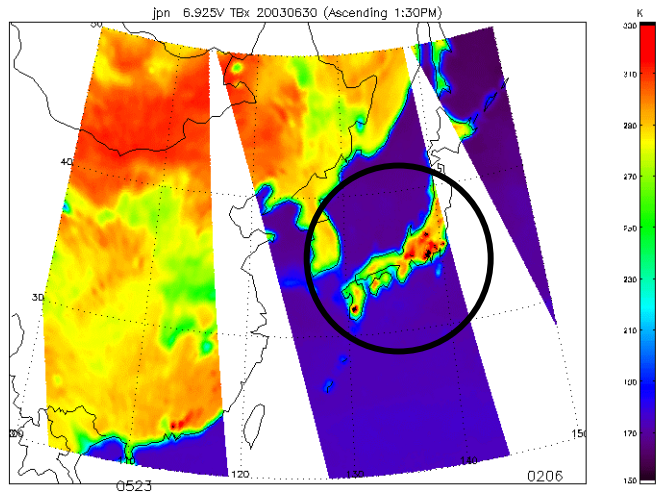
SMMR 6.6 GHz

AMSR-E 6.9 GHz

1979




2003

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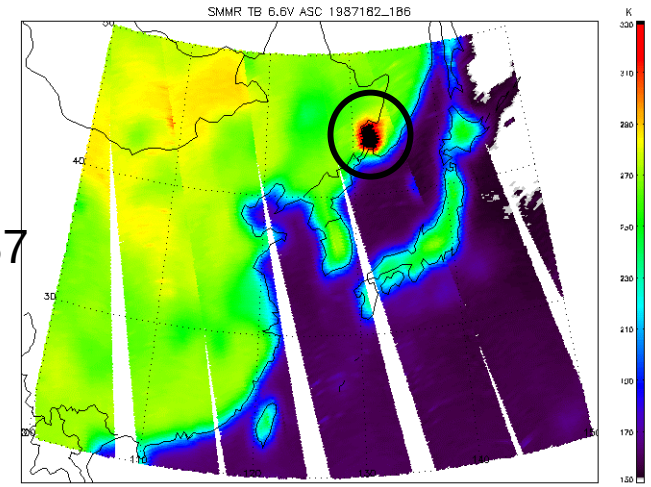


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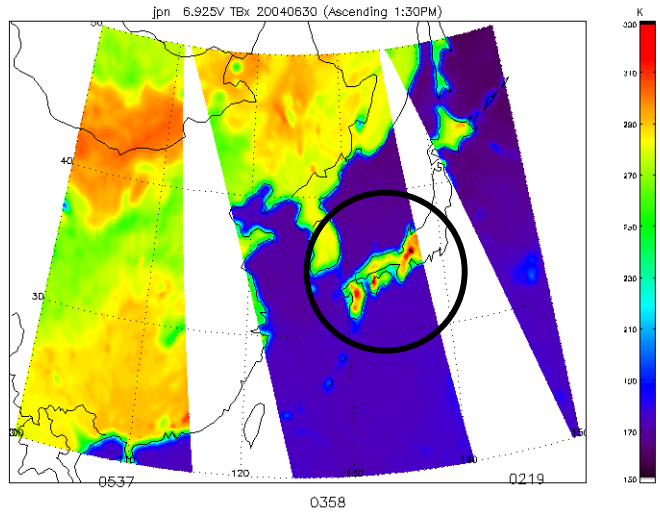
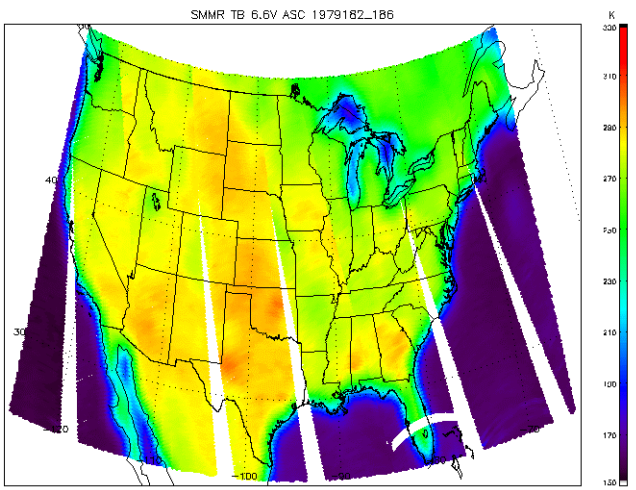


# North America at 6 GHz

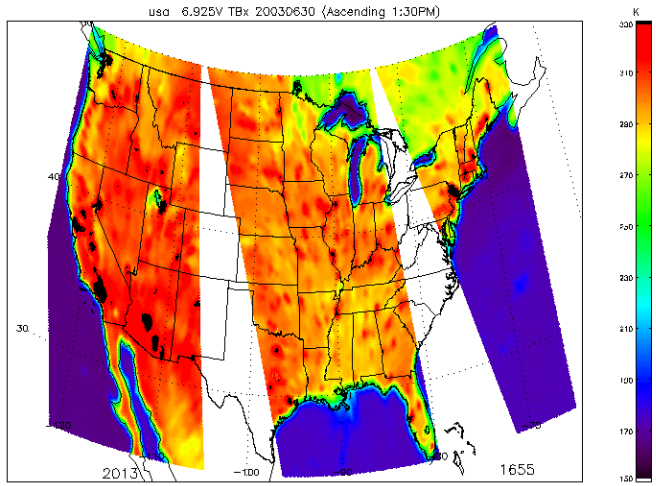
SMMR 6.6 GHz

AMSR-E 6.9 GHz

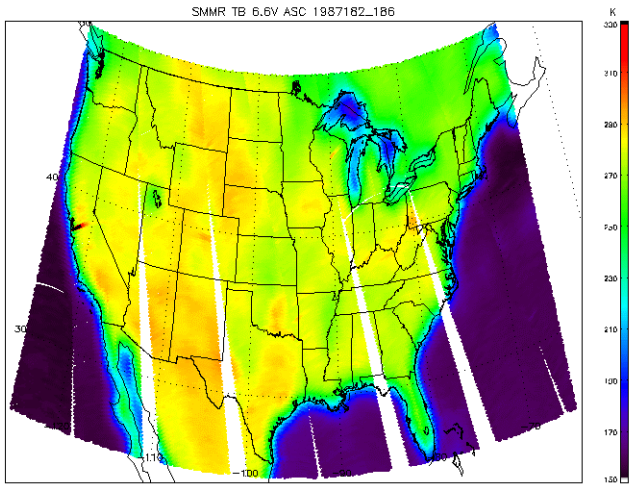
1979



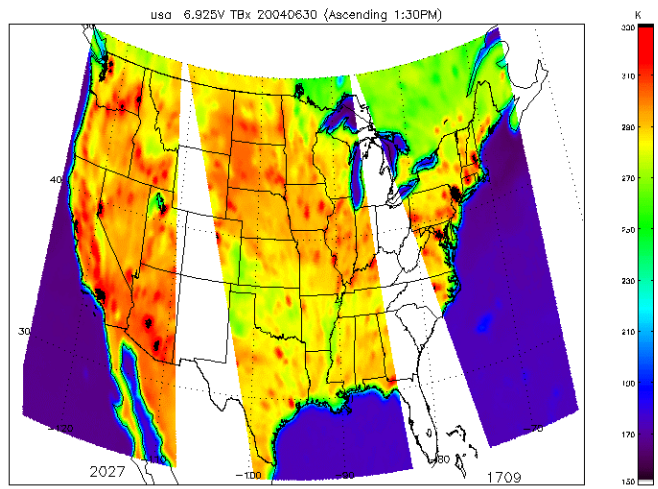

2003




1987



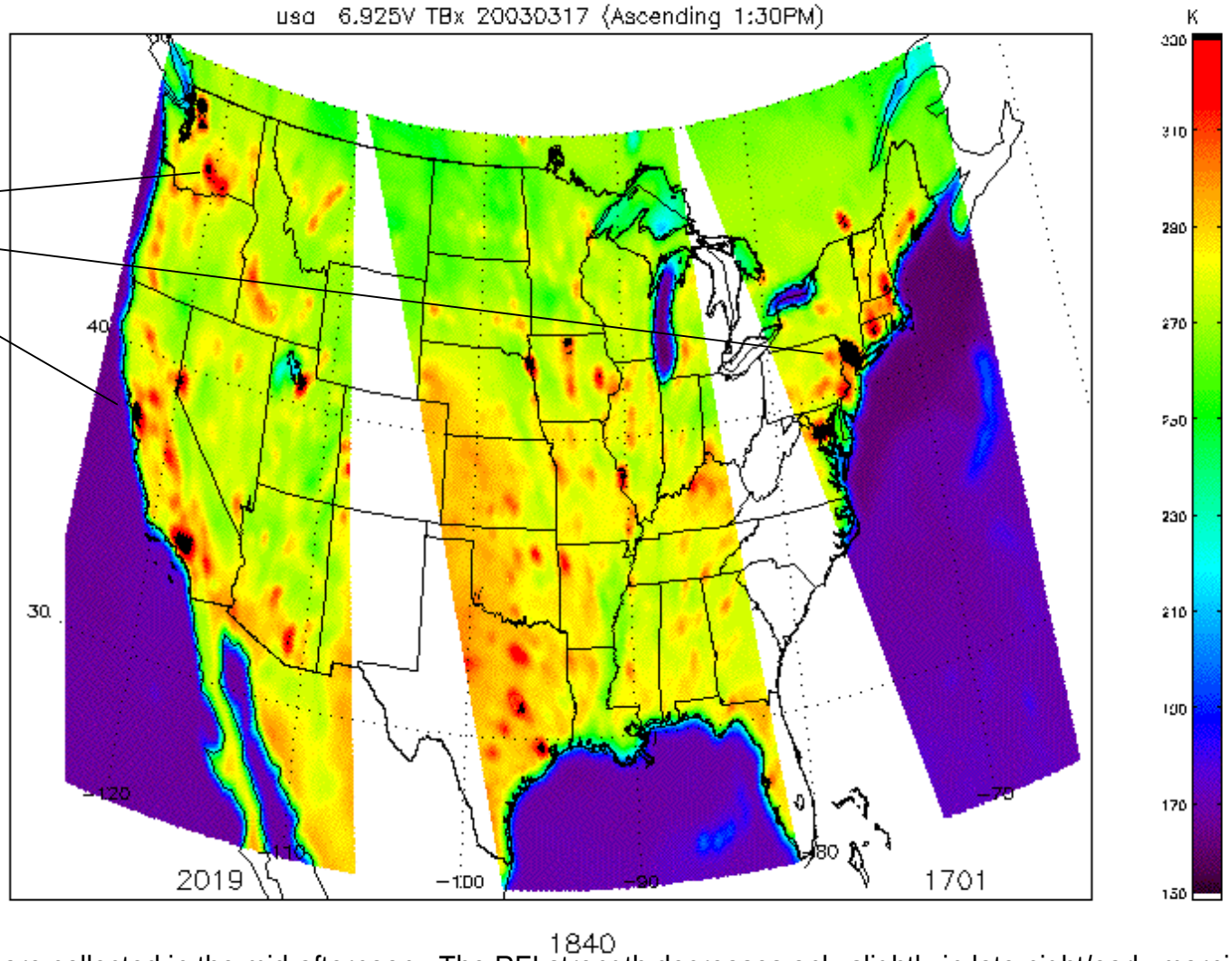

2004




1848

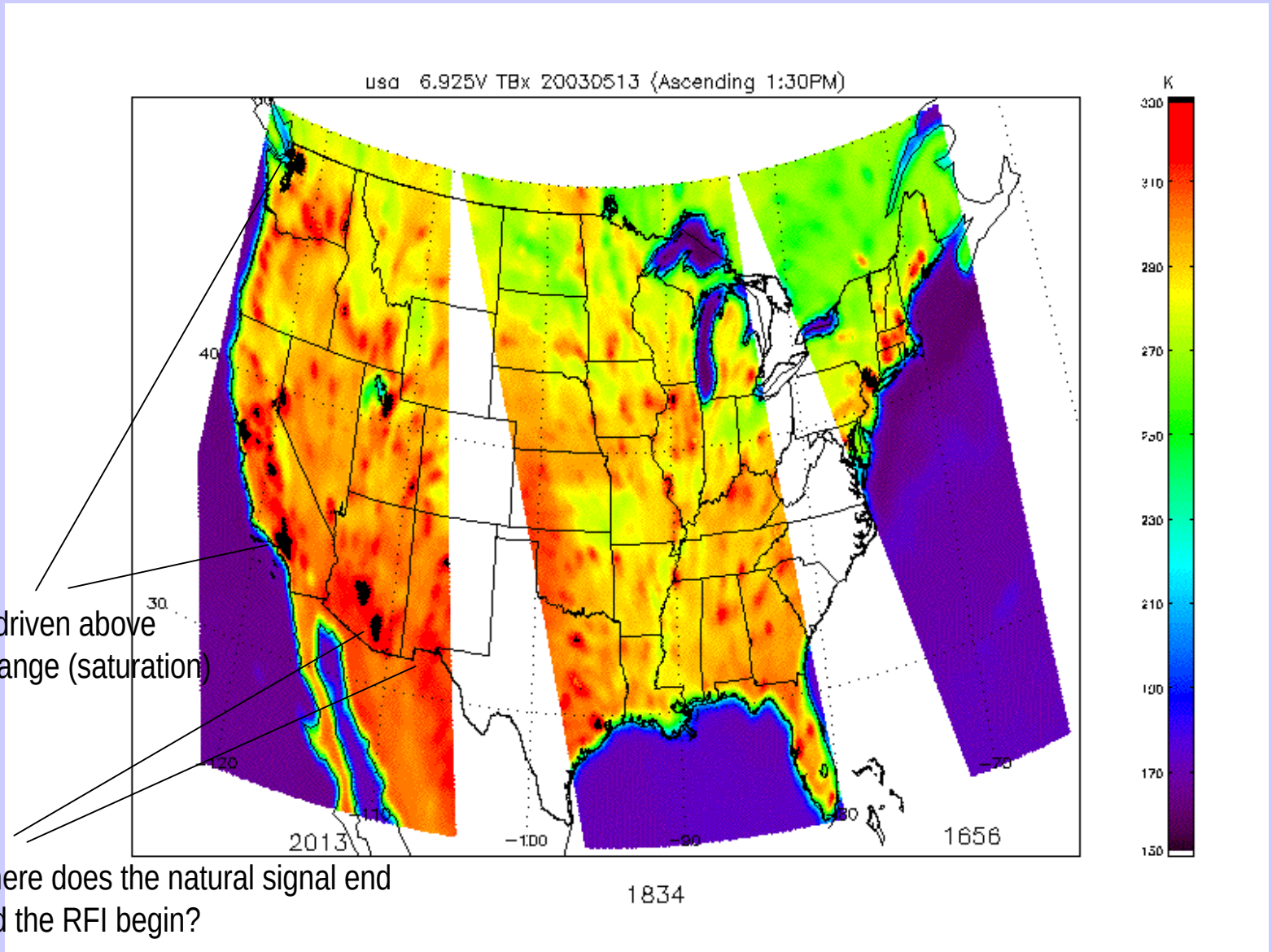
# RFI from Fixed and Mobile Services - NASA AMSR Instrument

RFI



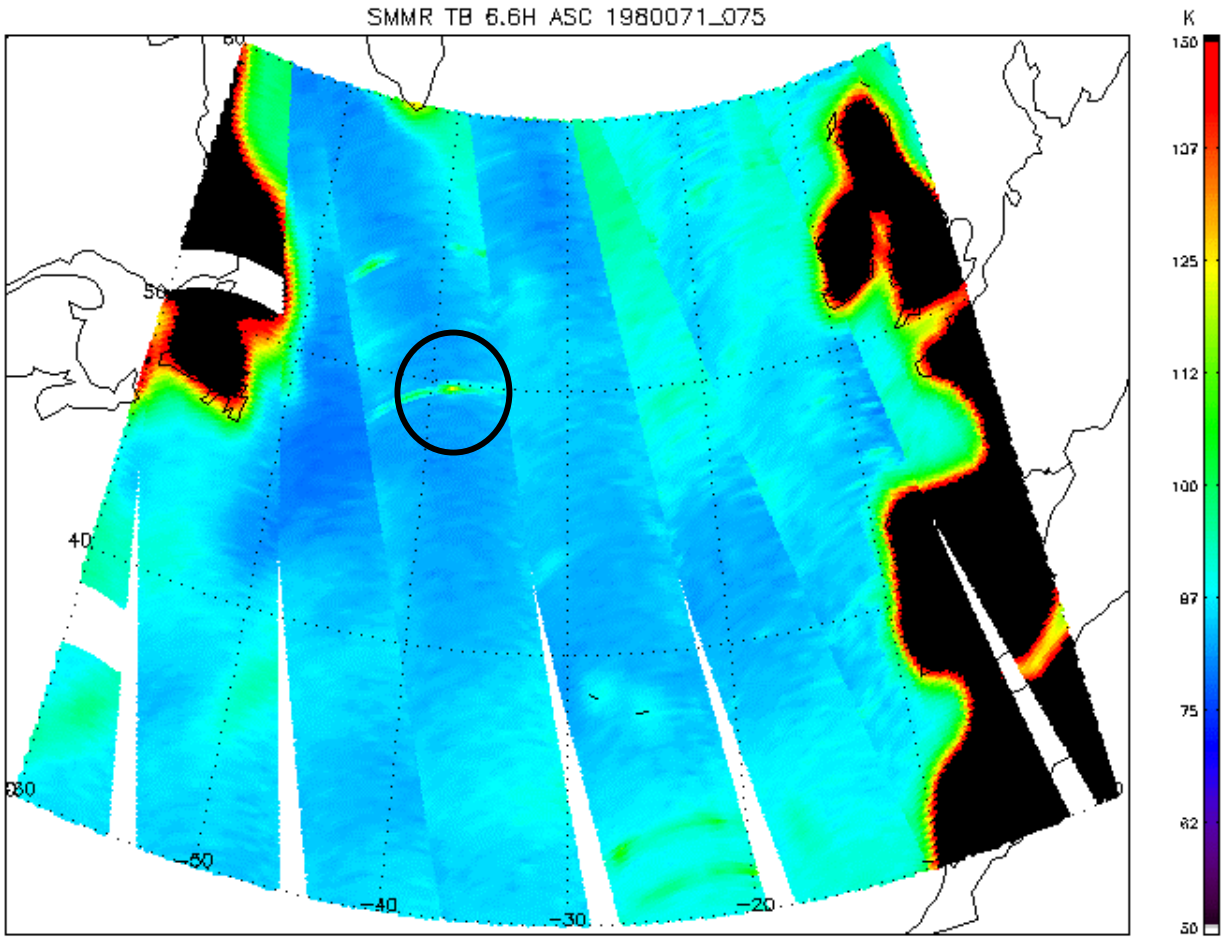

Note: These data are collected in the mid-afternoon. The RFI strength decreases only slightly in late night/early morning hours

# RFI from Fixed and Mobile Services - NASA AMSR Instrument




Receiver driven above dynamic range (saturation)

Where does the natural signal end and the RFI begin?



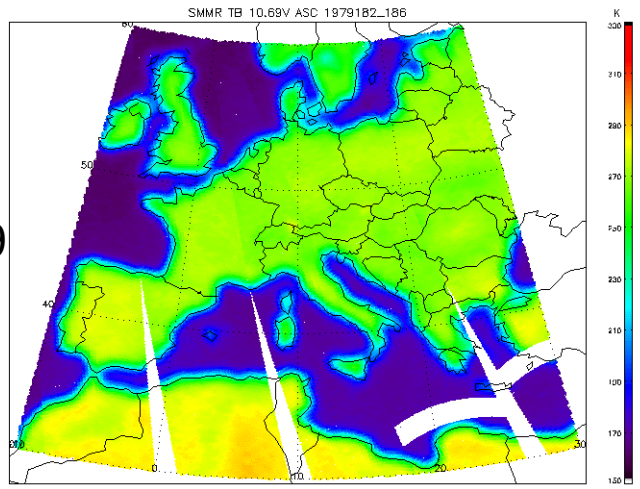

Several regions were found where retrieved SST standard deviation exceeded 15° C

# Europe at 10 GHz

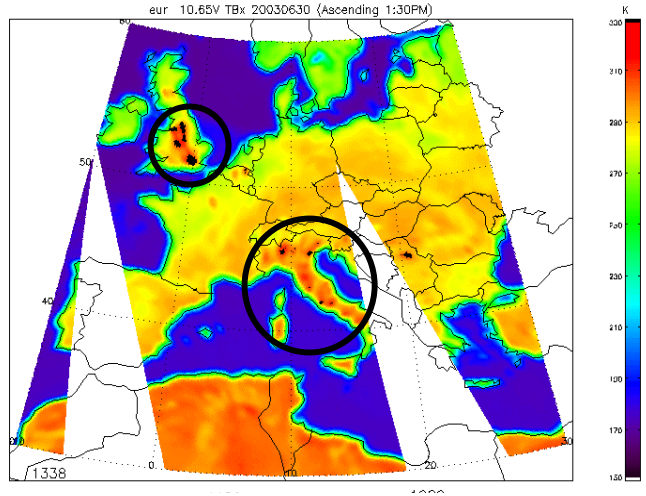
SMMR 10.69 GHz

AMSR-E 10.65 GHz

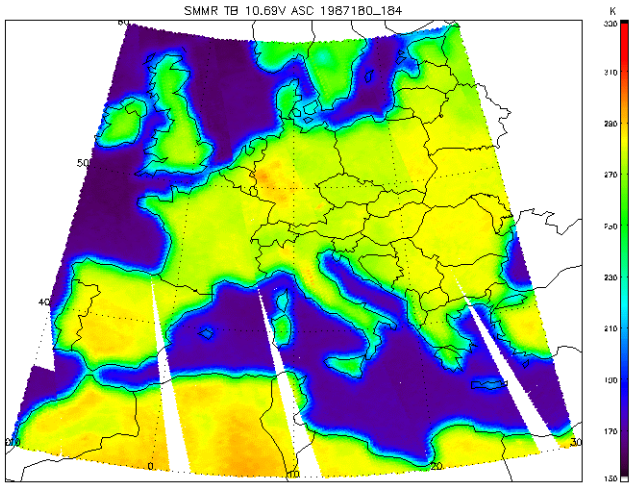
1979



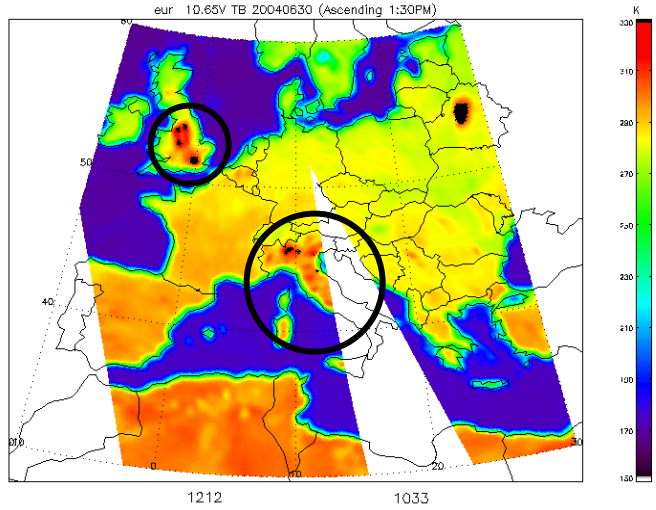

2003




1987




2004

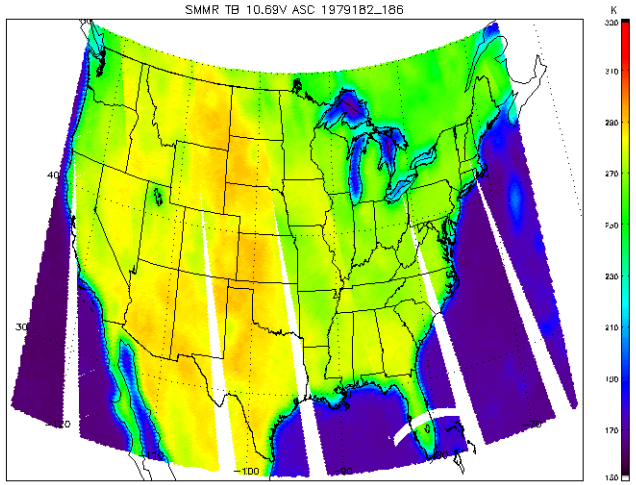


# North America at 10 GHz

SMMR 10.69 GHz

AMSR-E 10.65 GHz

1979

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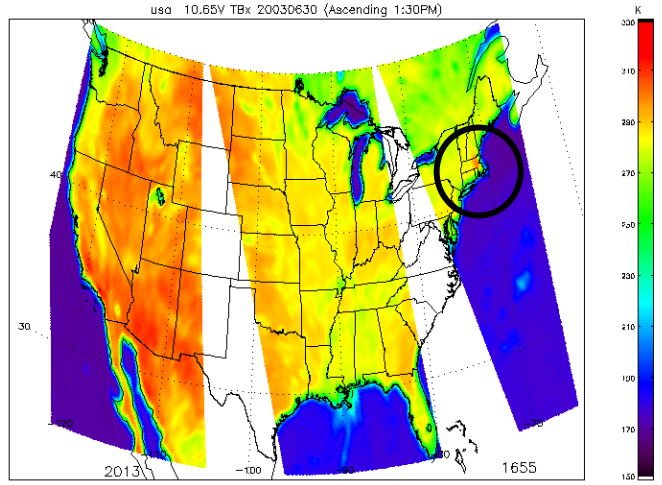
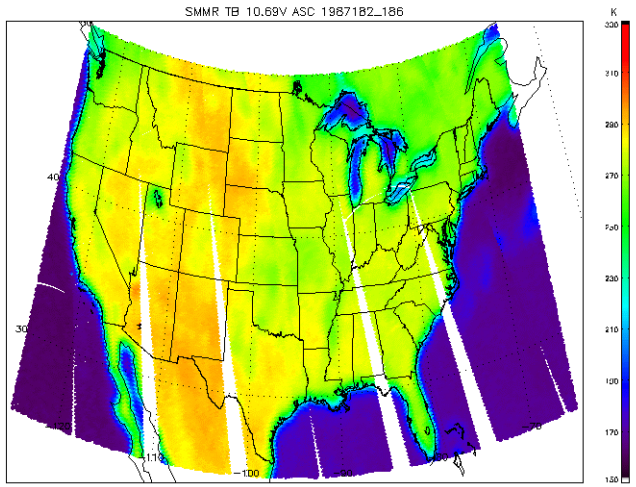
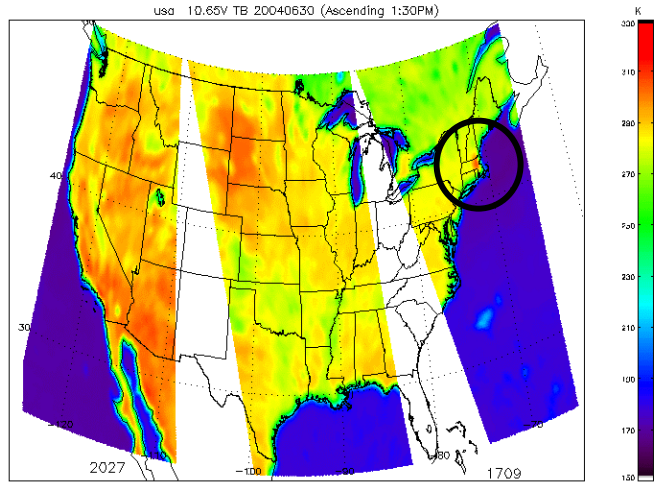



1987

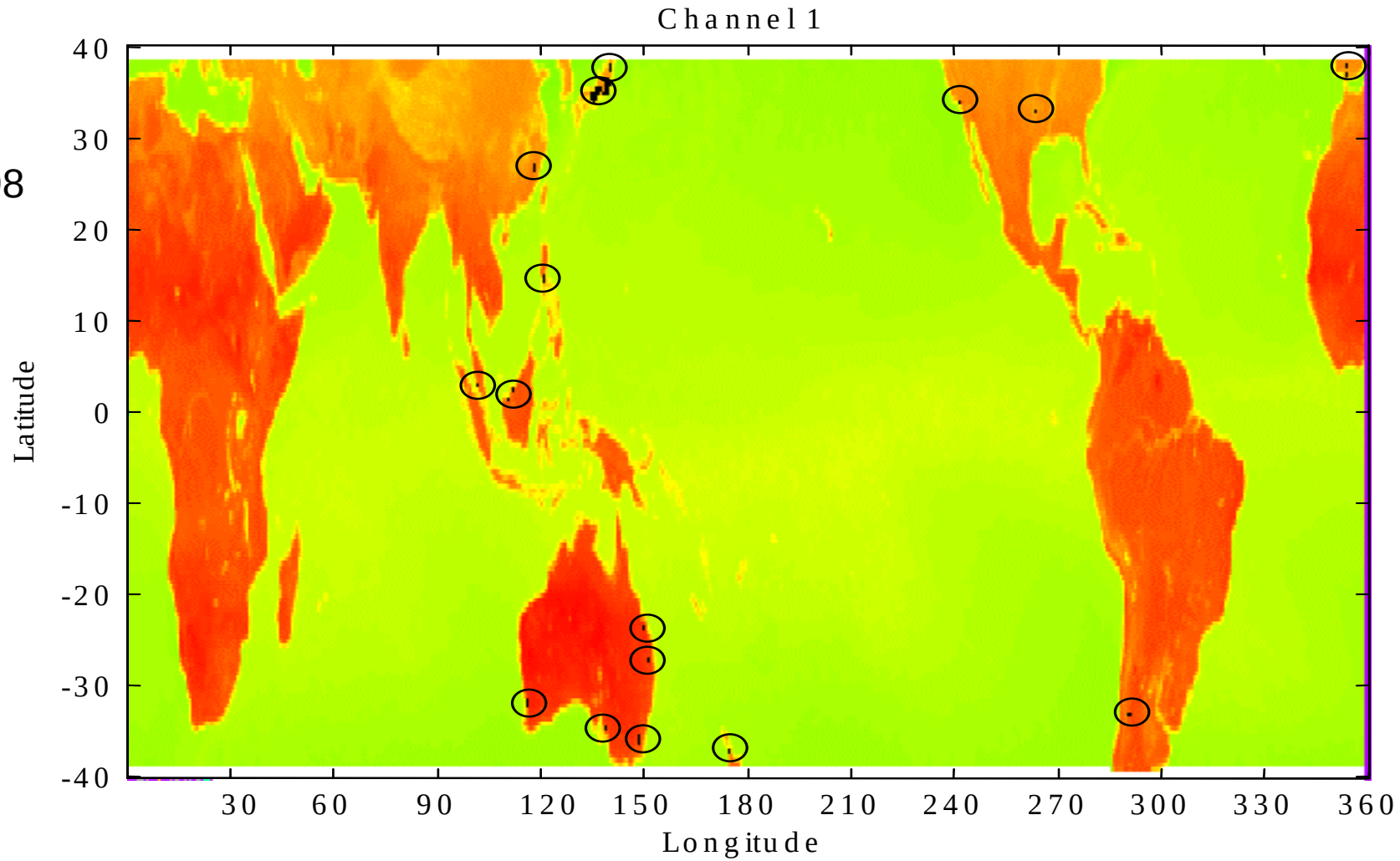



2004



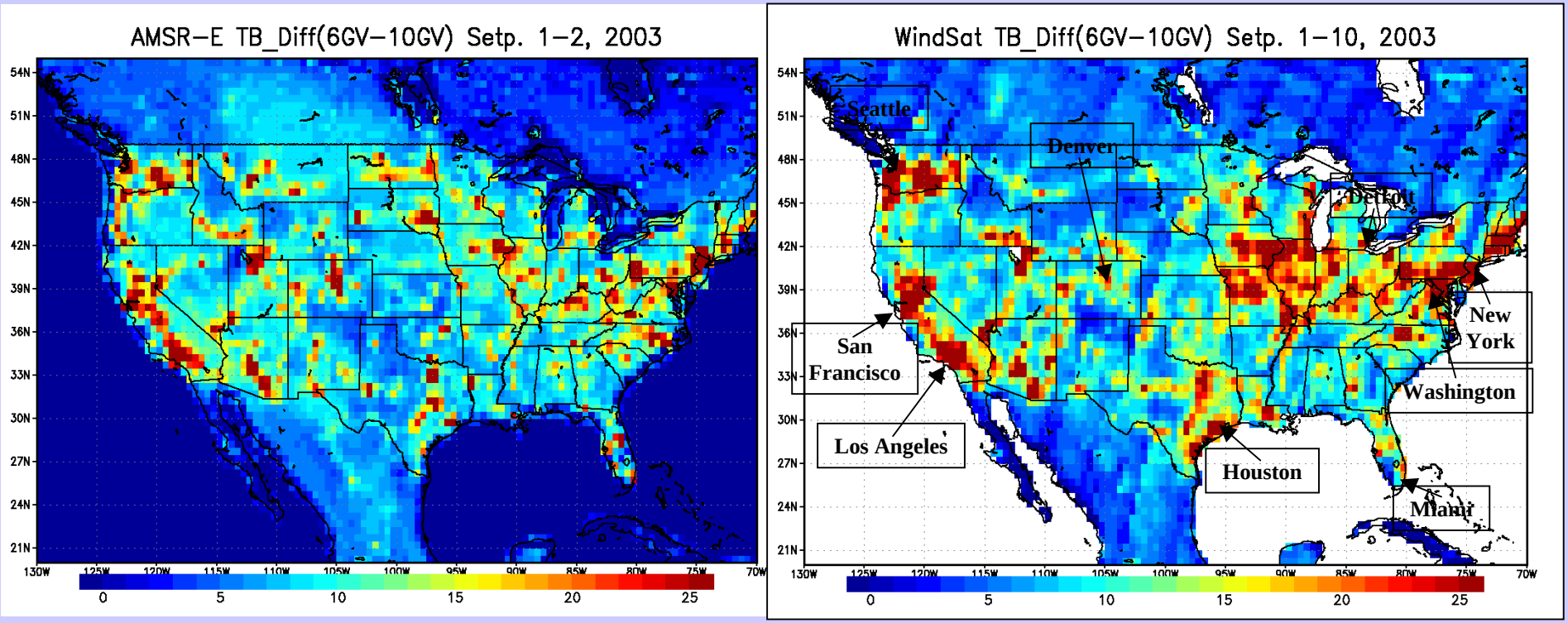
# Observations of RFI from TMI (10.65 V)

1998




**RF interference with TMI for first several months of operation. Black circles are to enhance the visibility of the interference and do not represent the actual extent of the interference.**

# *RFI in AMSR-E and WindSat*

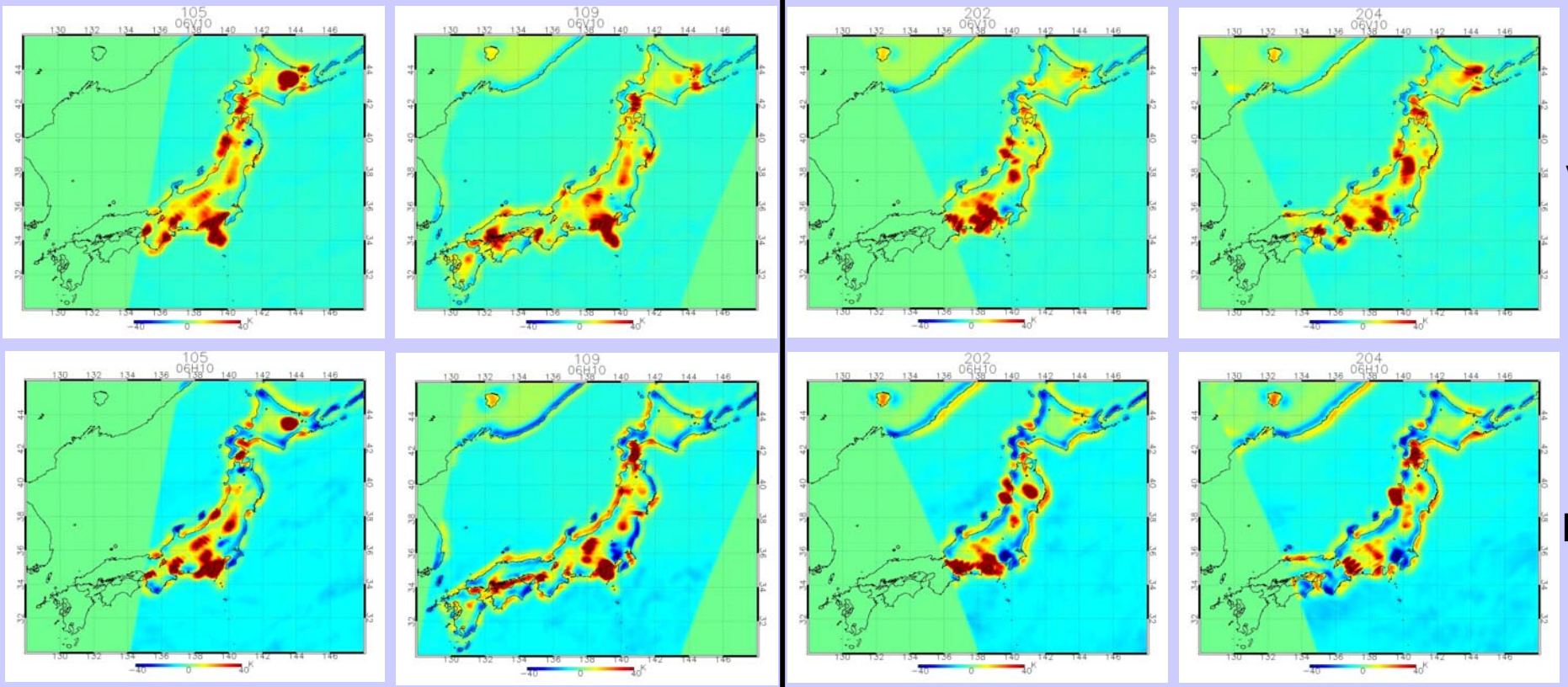



Distribution of brightness temperature difference between 6 and 10GHz vertical polarization channels over the United States of America for AMSR-E (left) and WindSat (right). Data are averaged for 2 days and 10 days for AMSR-E and WindSat, respectively.

# RFI (Radio Frequency Interference) over Japan

Descending

Ascending



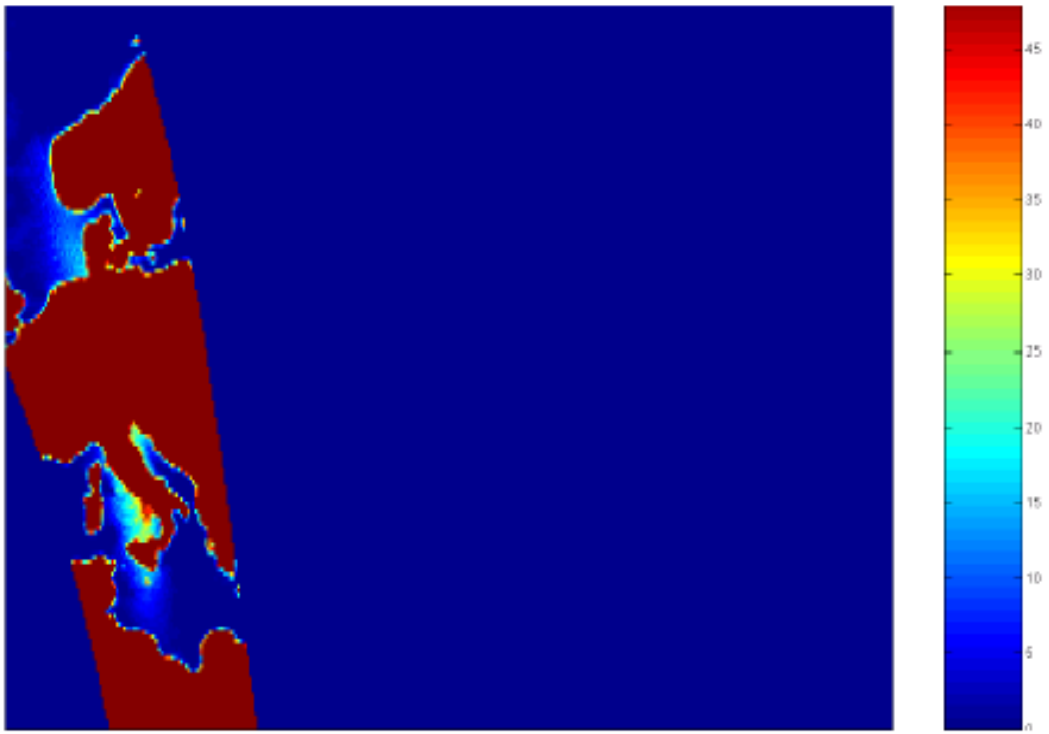

Yearly average of brightness temperature difference between 6.9GHz and 10.65GHz channels for specific satellite paths to show examples of possible man-made emissions at 6.9GHz indicated by red areas (coastal red areas do not necessarily correspond to man-made emissions due to beam size difference of 6.9 and 10.65GHz).

# 10 GHz RFI Over Ocean: WindSAT

Geostationary Broadcast Satellite believed to be operating near 10.71 GHz

WindSat Orbit 3097: Ascending pass over Europe, 10.7 GHz h-pol

Average of forward and aft observations. RFI just seen by aft observation, so true effect is twice that of what is show here




**WindSat**

- Built by the US Naval Research Laboratory
- Launched 06-Jan-2003
- 10 GHz Channel: 10.55 to 10.8 GHz

The location and amplitude of RFI depends on viewing geometry

Impacts:

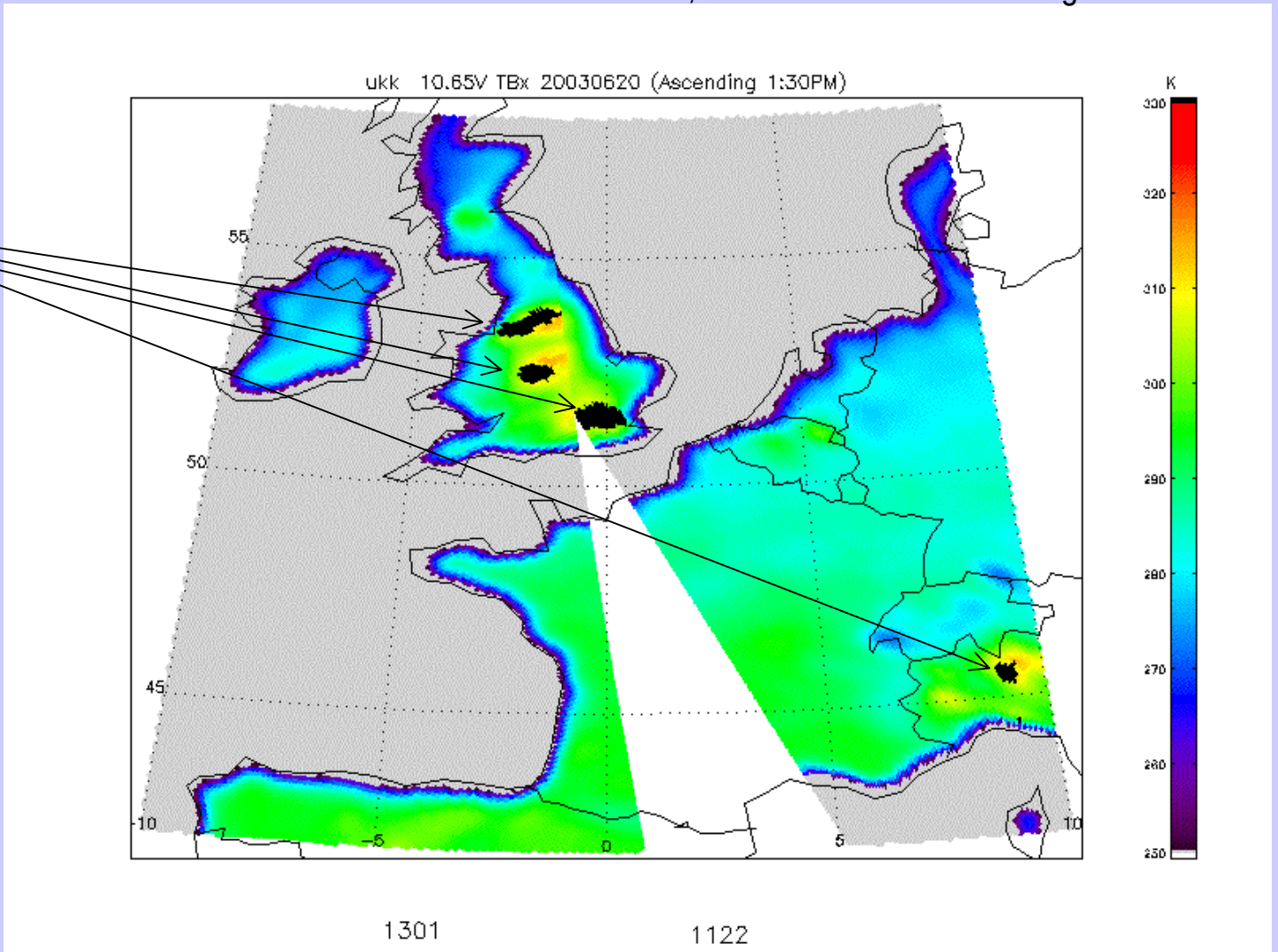
Sea Surface Winds

Sea Surface Temperature

# X-Band Interference in the United Kingdom and Italy

This channel is a shared Earth Exploration Sattelite Service allocation with Fixed Service.
Current allocations in the US are also shared with the Fixed Service, and is within the UWB range.

Sever RFI



# SFCG-24 , PERROS-GUIREC, hosted by ITWG


http://guy.rochard.free.fr/meteo/fichiers/SFCGITWG.doc

http://guy.rochard.free.fr/meteo/fichiers/SFCG24_Roger_Saunders.ppt

as well as extensions with SFCG and the url http://www.sfcgonline.org/

# *SFCG ACTION ITEM No. 24-3-1*

***SUBJECT: Update of EESS Passive Band Requirements***

***SFCG POSITION:***

***It is essential to improve, correct, complete, and consolidate the passive band requirements below 275 GHz, between 275 and 1000 GHz, and above 1000 GHz. It is important that this be accomplished prior to SFCG-25 ( BEIJING, 12 to 20 october 2005 )***

***ACTION TO BE TAKEN:***

***1.) The responsible person and contributors will work together to convene a workshop with passive remote sensing scientists and remote sensing spectrum managers in the spring of 2005 in order to reach agreement on the frequency bands and required radiometer sensitivities.***

***2.) SFCG members are to take the results of the workshop and provide the updated requirements for spaceborne passive sensors, along with accompanying scientific justification and technical feasibility, and input them to SFCG-25***

***RESPONSIBLE PERSON: Guy Rochard (ITWG)***

***CONTRIBUTORS: D. McGinnis (NOAA), K. Maeda (JAXA), J. Zuzek (NASA), E. Marelli (ESA), M.Dreis (EUMETSAT), R. Wolf (EUMETSAT), M. Vasiliev (RASA), Z.Sun (CMA) + others TBD as INDIA, BRAZIL…***

**Washington 5 & 6 april meeting :**

The group completed the evaluation of two “measurement functions”, water vapor and sea surface temperature. The group agreed this initial evaluation was a good start but should be continued and completed by “**correspondence groups**”, one correspondence for each measurement function. It was further agreed that the two correspondence groups would complete their initial assessments within 6 months with an interim assessment within 3 months.

Concerning the **first** group, the contact point is : Darren McKague and

Concerning the **second** group, the contact point is : Jeff Peipmeier (see attendees list).

A **third** group dealing with temperature profiles is created with Jean-Noel Thepaut and Steve English .

➔ **Other** groups are needed: land surface, climate, clouds,limb sounding... **Who can help ?**

# Topics to study more completely :

**Below 40 GHz :To consolidate as the exemple of S.English**
**http://guy.rochard.free.fr/meteo/fichiers/SENGLISH24GHz.doc**

**Above 275 GHz : for nadir / geo sounding ? Bandwidths ?**

**and : for nadir / clouds ? Bandwidths and Delta T ?**

**Above 275 GHz : limb sounding / convergence NASA, JAXA, ESA…Delta t ?**

**Monthly (?) emissivity atlas over land on a Worldwide basis as a reference**

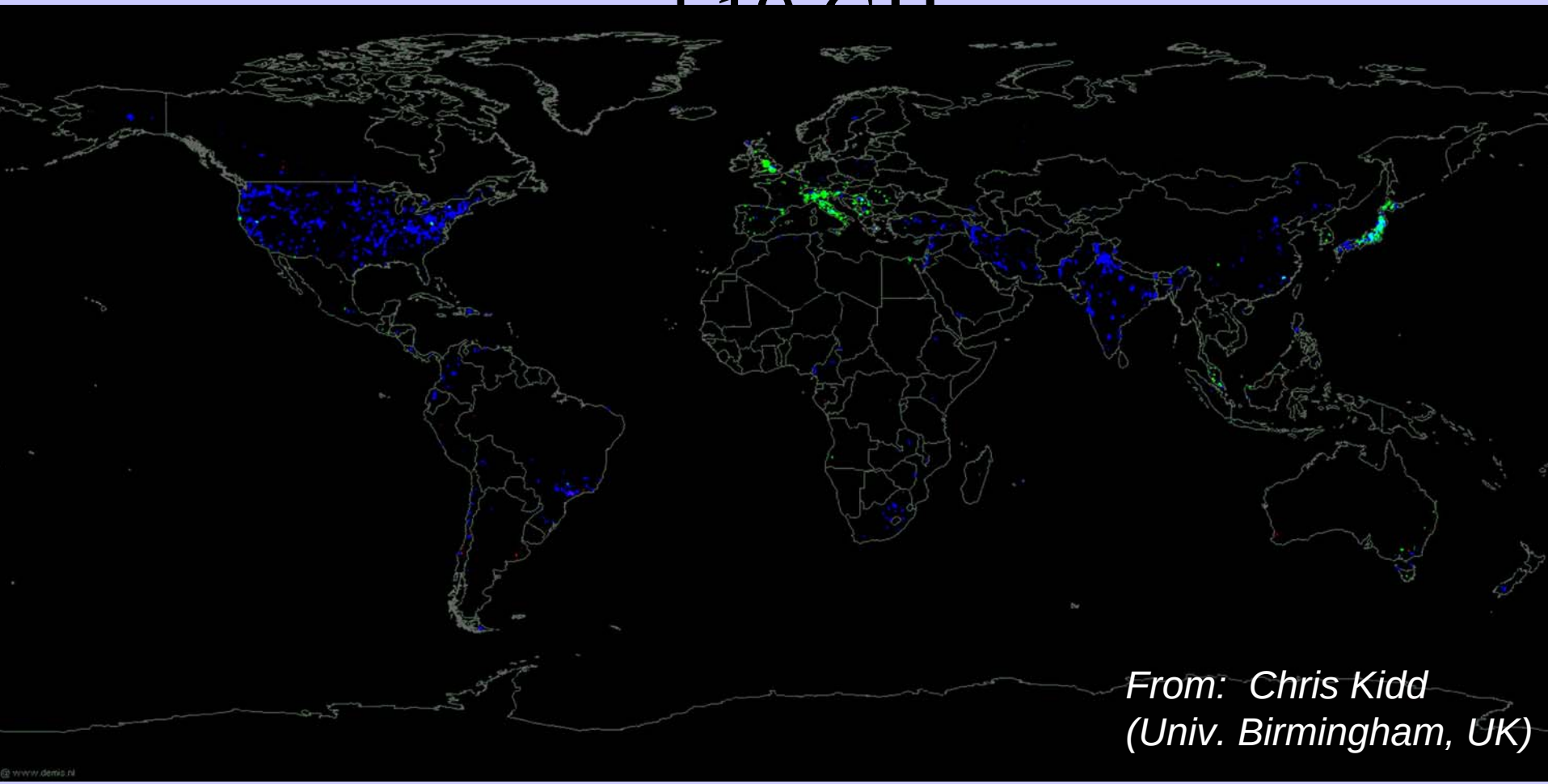
## Next steps :

- SPIE-50 (San-Diego, G.Rochard) and IGARSS'O5 (Seoul, D.Kunkee) end of next july with need to continue in 2006 maybe with AMS ?
- SFCG-25 (Beijing, TBD) next october , ITU-7C (spring 2006)
- Cooperation with radioastronomers above 275 GHz
- Redaction of a reference scientific hanbook for end of 2006.

***It will be necessary to find somebody else to manage the passive microwave frequency protection. Any suggestion is welcomed starting now. Young people could bring a new eye on the topic !***

***news :*** Washington.doc

# Example: Detectable RFI at 6, 10 and 19 GHz




Blue = 6.8 GHz, Green = 10.7 GHz, Red = 19.4 GHz

*This ppt is on :*

**http://guy.rochard.free.fr/meteo/fichiers/Protect.ppt**