# A Physical Model for Television Frequency Interference (TFI) Correction of AMSR2 Data over Ocean near U.S. and Europe

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# Outline

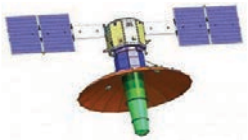
- Introductions
- Implementation Procedures
- Numerical Results
- Summary and Conclusions

# AMSR2 Instrument Characteristics

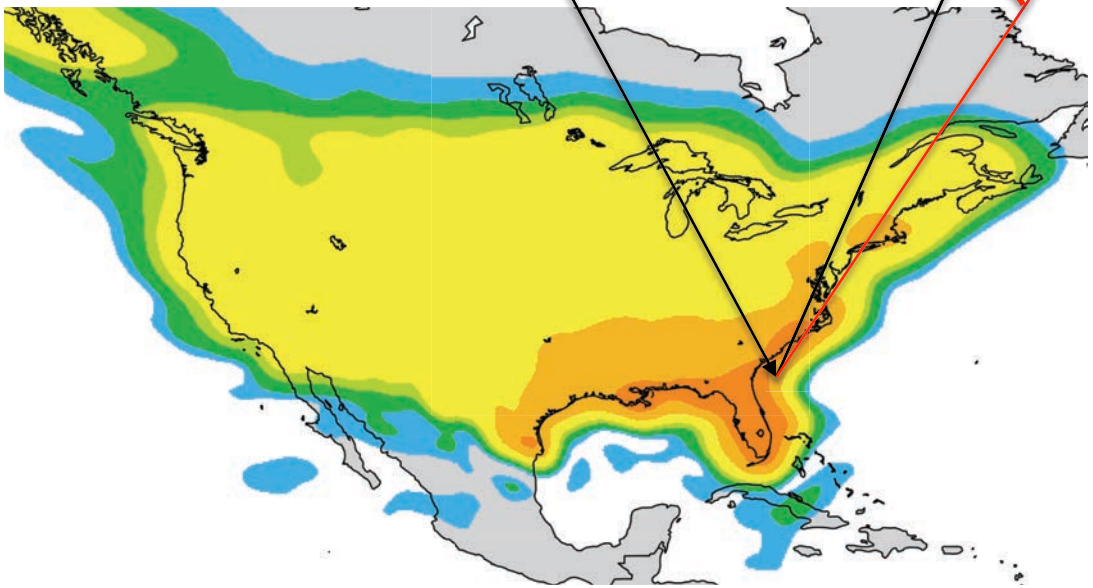
| Channel Frequency [GHz] | Band Width [MHz] | Beam Width [deg] | IFOV [km] | NEDT [K] | Sampling Interval [km] | Pol. |
|---|---|---|---|---|---|---|
| 6.925 | 350 | 1.8 | 35×62 | 0.34 | 10 | H/V |
| 7.3 | 350 | 1.8 | 34×58 | 0.43 | | |
| 10.65 | 100 | 1.2 | 24×42 | 0.7 | | |
| 18.7 | 200 | 0.65 | 14×22 | 0.7 | | |
| 23.8 | 400 | 0.75 | 15×26 | 0.6 | | |
| 36.5 | 1000 | 0.35 | 7×12 | 0.7 | | |
| 89.0 | 3000 | 0.15 | 3×5 | 1.2 | 5 | |

# Introduction

DirecTV 11 at 99.2 W
or
DirecTV 10 & 12 at 102.8 W



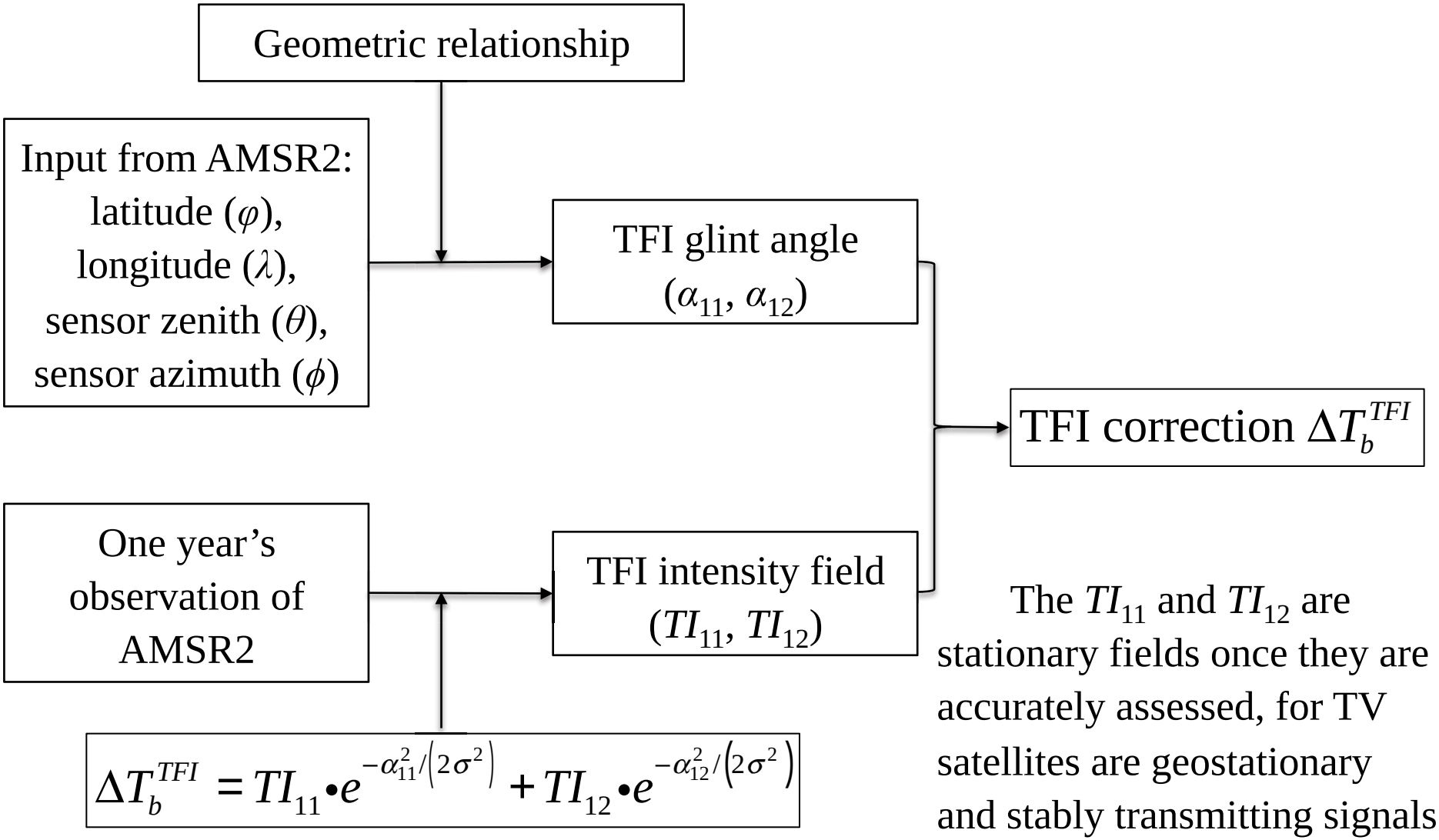
AMSR2




The smaller $\alpha$ is:

- the more probable the interference is going to take place
- the stronger the intensity of the interference is

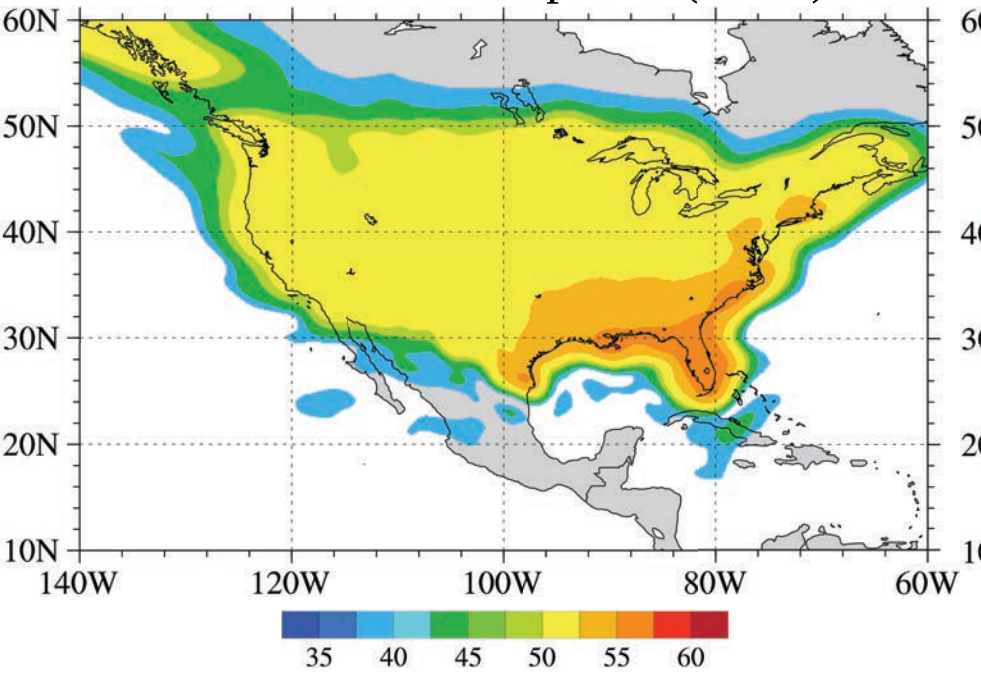
# Implementation Procedures



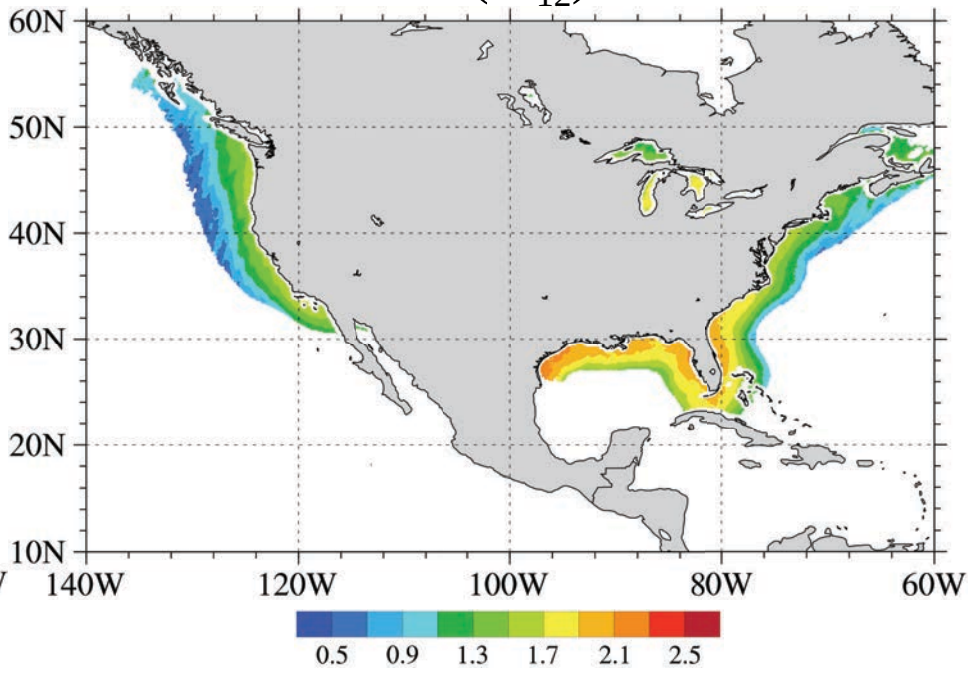

The $TI_{11}$ and $TI_{12}$ are stationary fields once they are accurately assessed, for TV satellites are geostationary and stably transmitting signals to their consumers.

# TV Signal Intensity

DirecTV 12 Footprints (dBW)

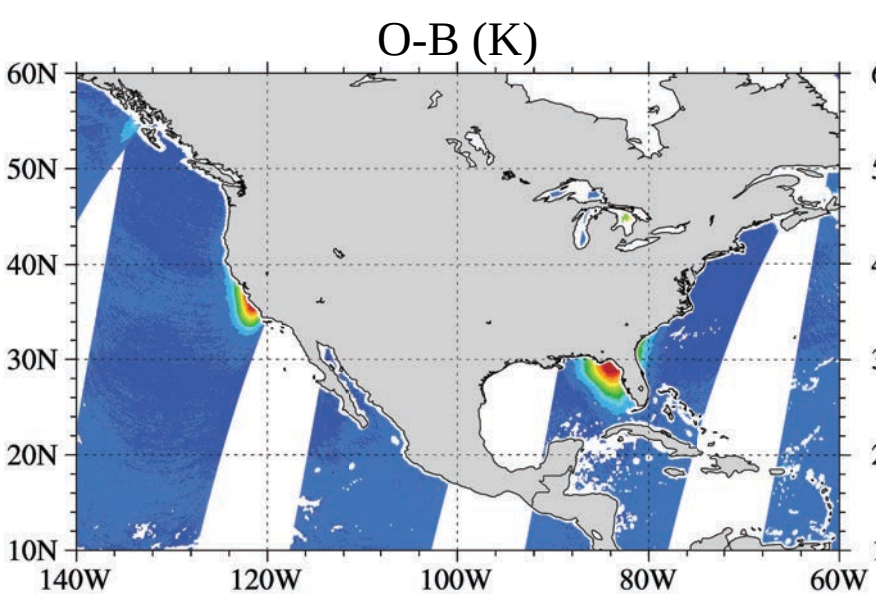


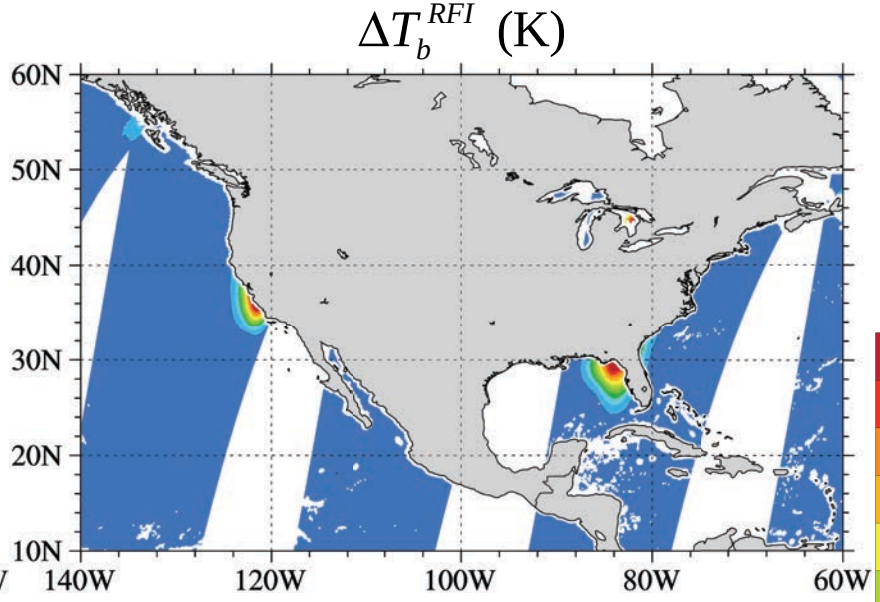

$\ln(TI_{12})$

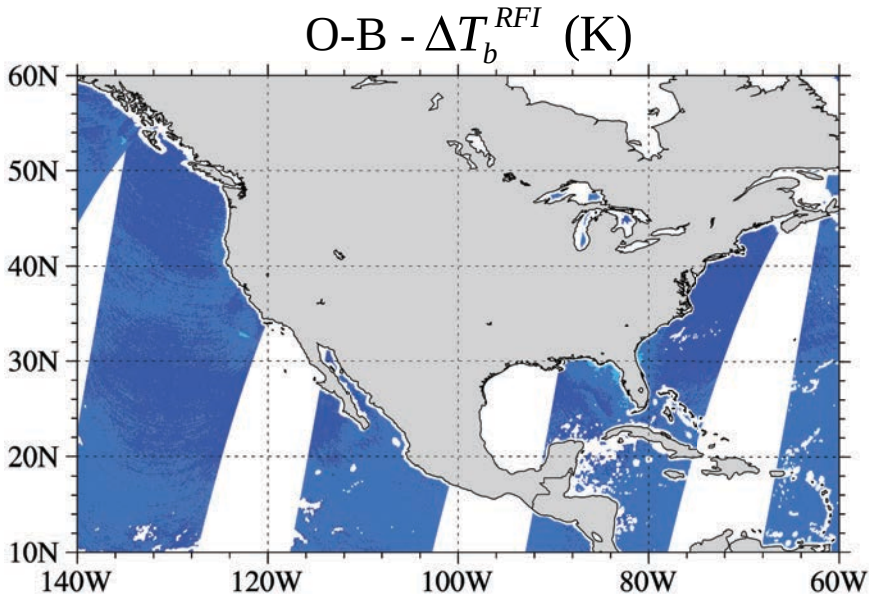


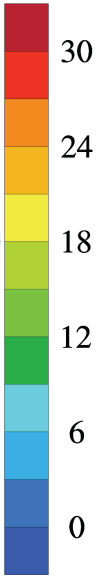

- The conceptual TV satellite footprints data are available at http://www.satbeams.com/footprints?beam=6219
- $TI_{12}$ is calculated backward with one year's AMSR2 observation, without any form of reference to the footprints in the left panel.

# Correction Term – 18.7h



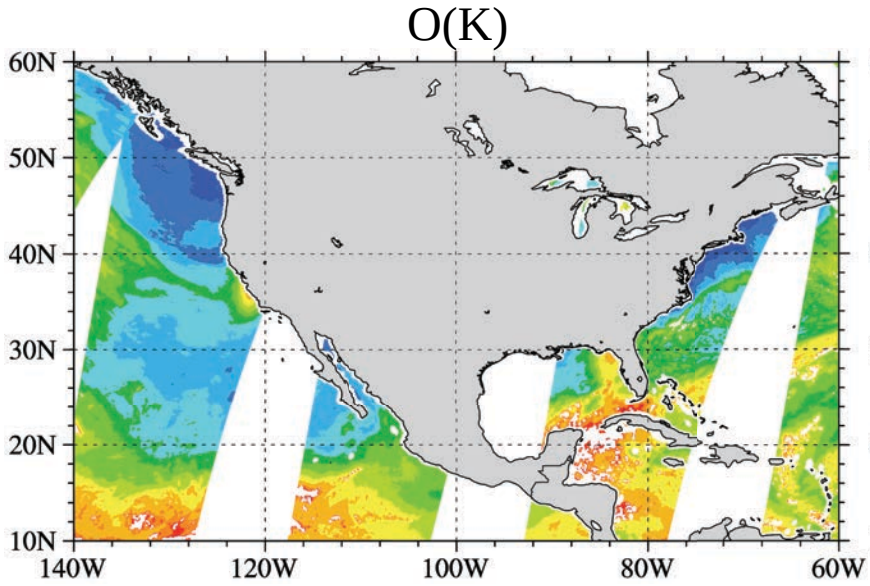



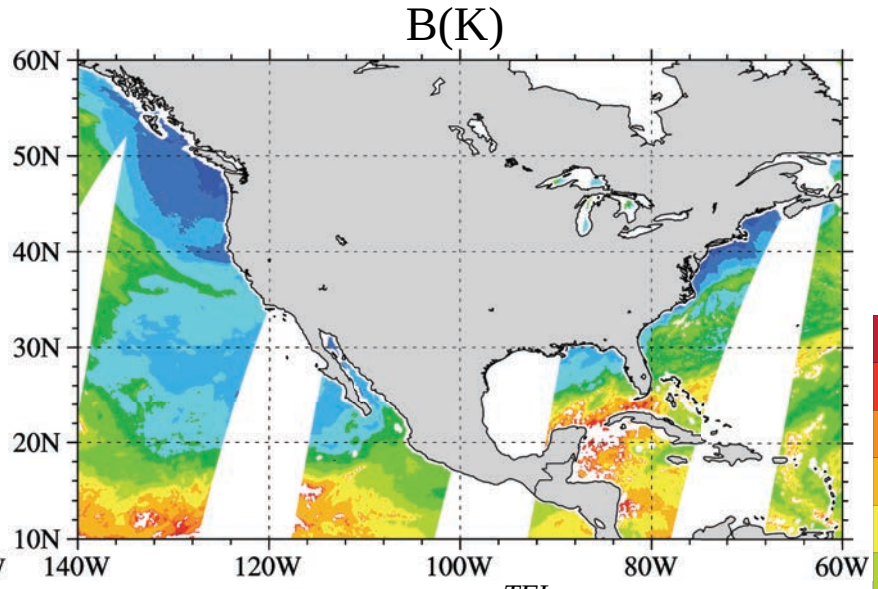



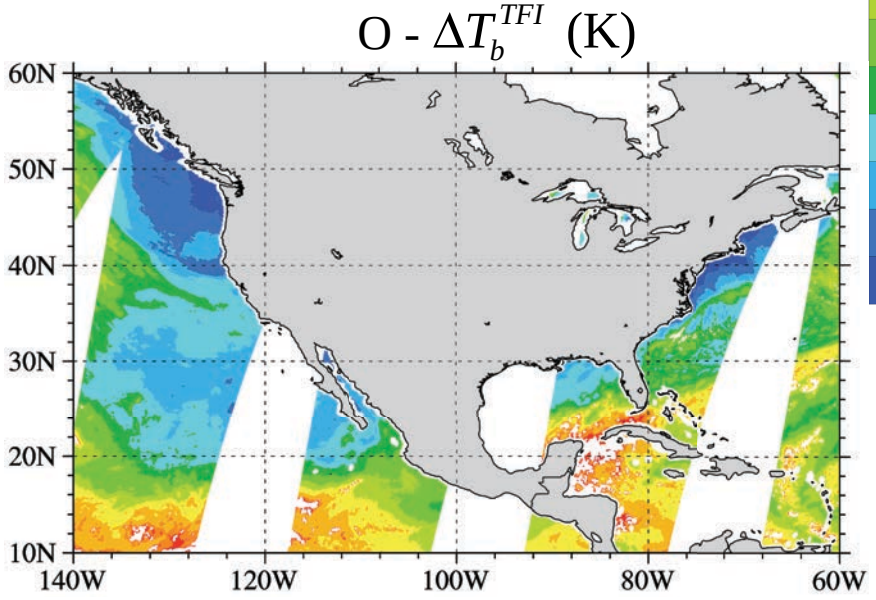



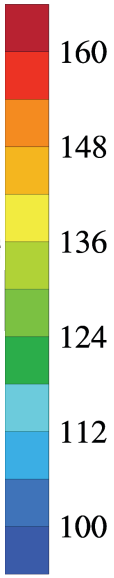

- Data and numerical results plotted are from AMSR2 observations on Jan 4, 2014.
- Background $T_b$ are calculated based on the regression method proposed by Li *et al*, 2006.
- Both the shapes and intensities of interferences can be well captured.

# Corrected $T_b$ – 18.7h



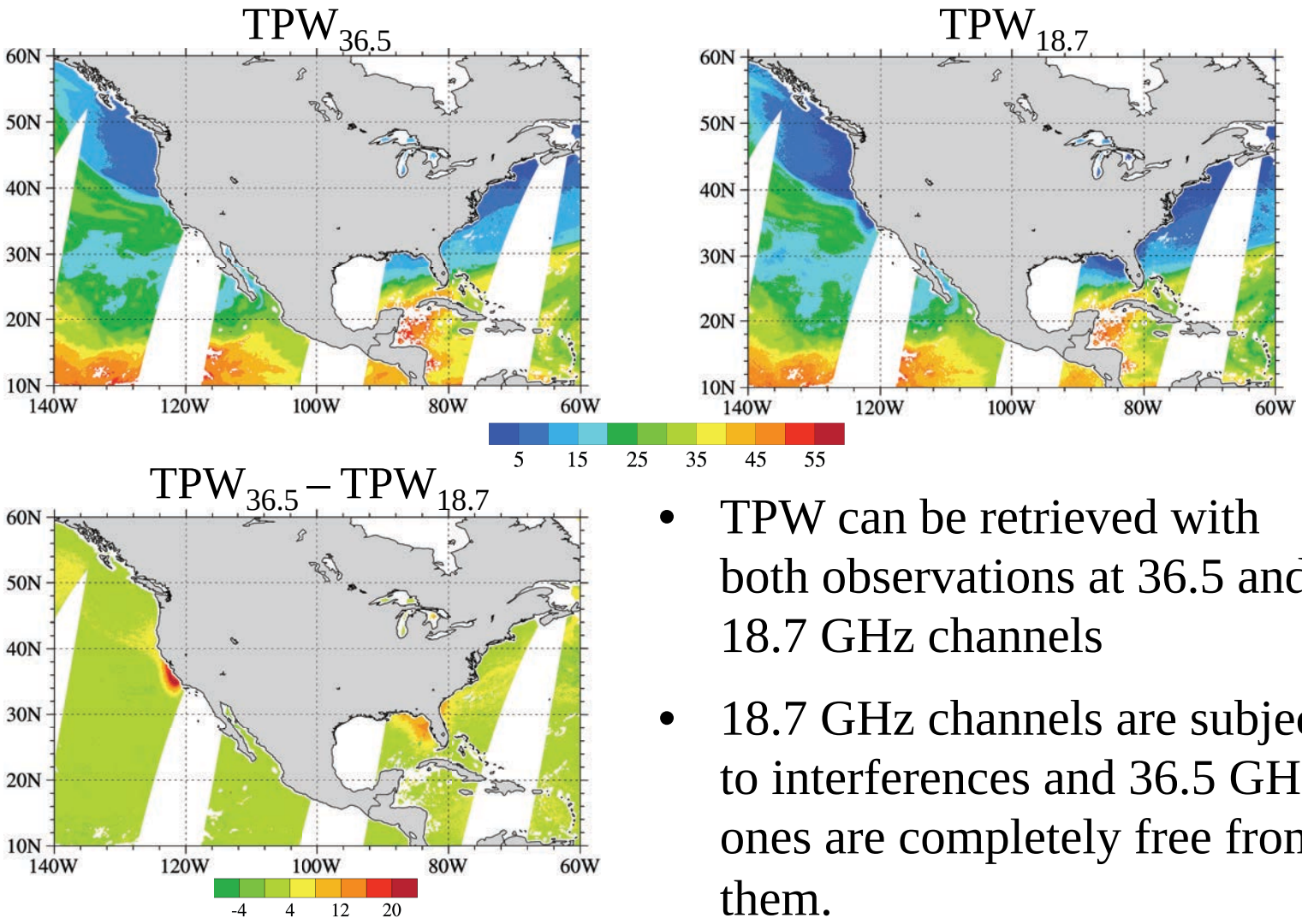



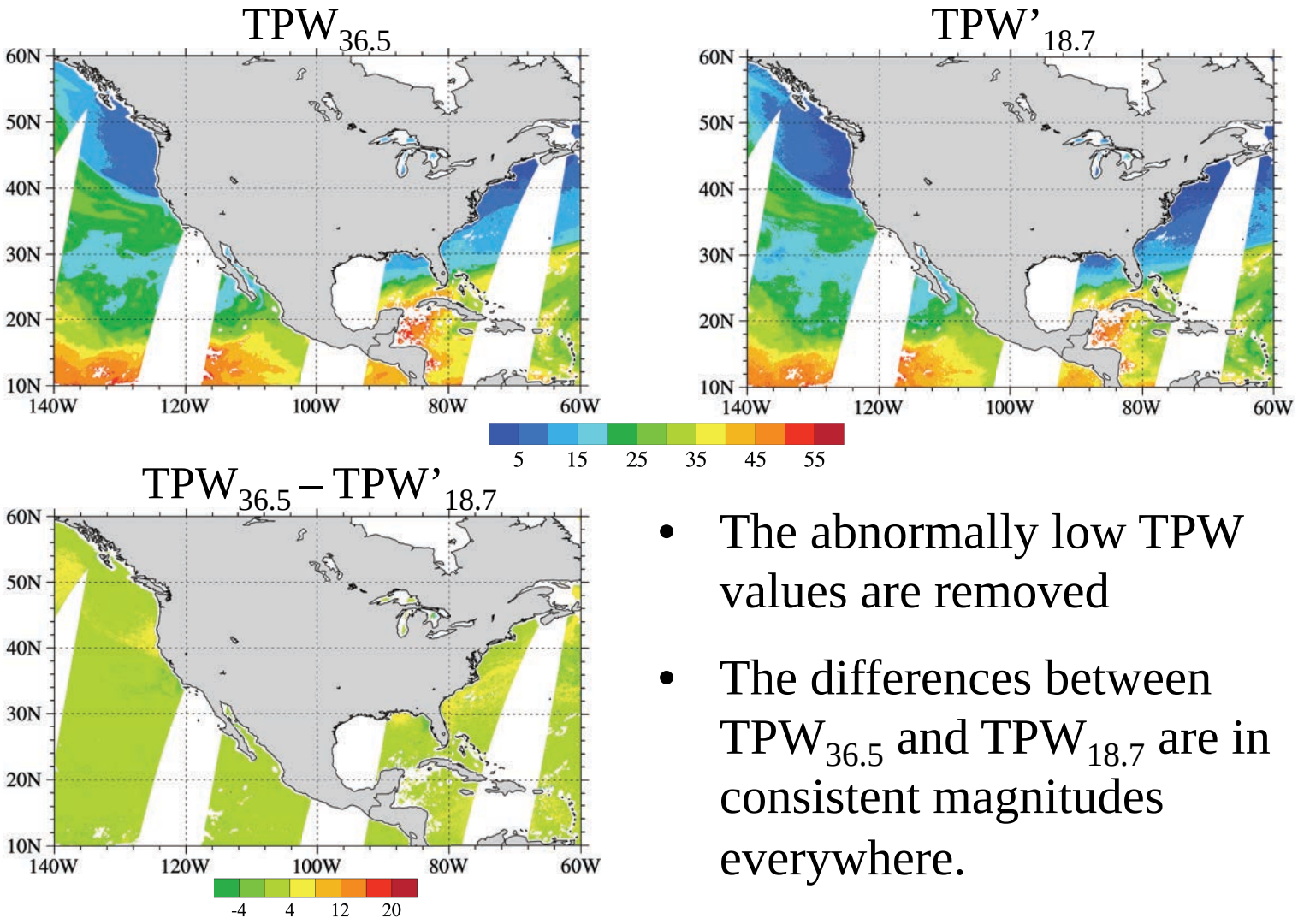

The natural radiation information concealed by TV signals at the interfered pixels can be revealed by applying the mitigation term upon the observations.

# TPW Retrieval Without TFI Correction




- TPW can be retrieved with both observations at 36.5 and 18.7 GHz channels
- 18.7 GHz channels are subject to interferences and 36.5 GHz ones are completely free from them.

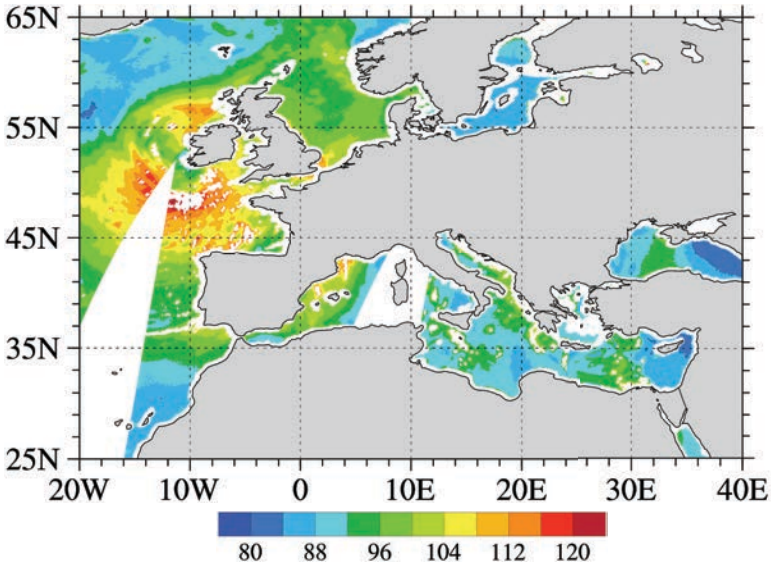
# TPW Retrieval With TFI Correction



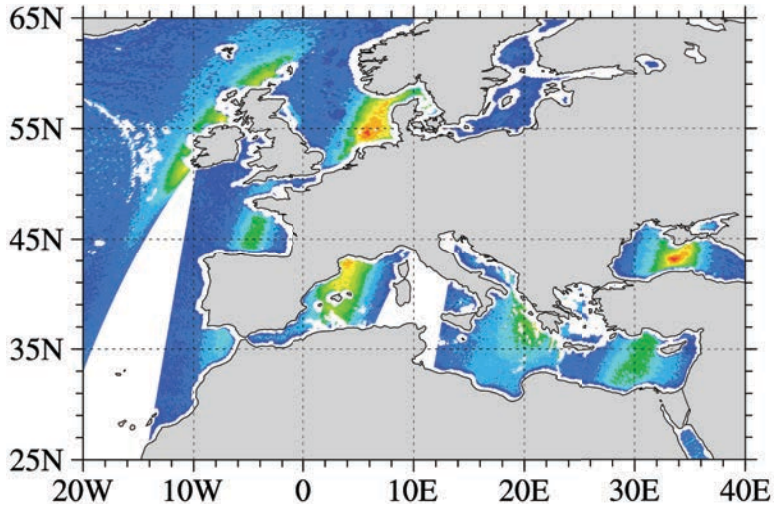

- The abnormally low TPW values are removed
- The differences between $TPW_{36.5}$ and $TPW_{18.7}$ are in consistent magnitudes everywhere.

# TFI in Europe – 10.65h

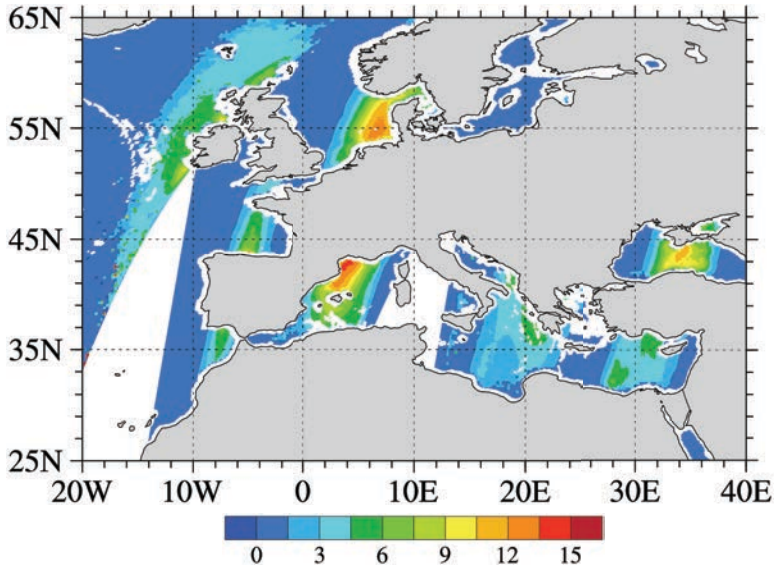
O




O-B




TFI correction




- TFI in Europe are caused by 5 TV satellites in total
- This physical model can capture simulate all of their impacts.

# Summary and Conclusion

- TFI at K-band are contributed jointly by DirecTV 11 at 99.2W and DirecTV 12 at 102.8W.
- The geographical and intensity distributions of TFI can be determined with simply the observation geometry of the imager instrument.
- The observations over the interfered pixels can be exploited instead of discarded as they used to be.