# Error Analysis of SSM/I F08 Antenna Temperatures to Produce an Extended Record of Observations for Climate Applications

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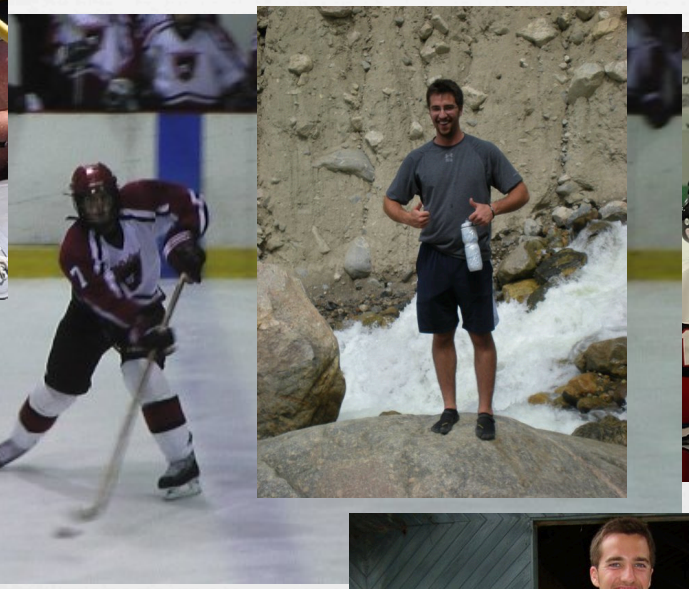
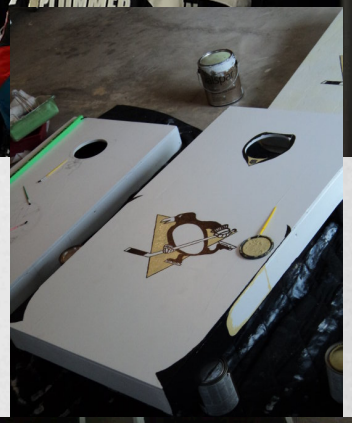
# About Me





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# Overview

- Special Sensor Microwave/Imager (SSM/I) is a conically scanning window channel microwave radiometer
- Flown aboard the Defense Meteorological Satellite Program (DMSP) satellites
- The series of satellites forms the longest record of microwave measurements starting in 1987 and continuing through to the present with the Special Sensor Microwave Imager/Sounder (SSMIS)
  - Dual coverage for much of the record
- First sensor flew aboard the F08 satellite that was launched in June 1987 and flew until December of 1991
- F08 was the only SSM/I flown from 1987 to 1990

# Objective

- Many errors exist in this early data from F08
  - Correction of these errors is essential for the use of these data in long-term climate studies
- Several Quality Control (QC) checks are already applied
  - Climatology
  - Checks based on comparison of original and calculated geolocation
- Significant problems still exist
- Further QC check is required to identify bad scans
- In this study, we identify cases where additional QC is required and develop a new procedure that was added to existing procedures
  - This makes F08 data a viable part of the climate record.

# Methods

- Time tag for some scans for F08 was incorrect
  - Brightness temperature (TB) values were mis-located in both the original and calculated geolocation
  - Leads to land being mis-located over ocean and vice versa
  - Affected a large number of scans in a row in some swaths
- Procedure was developed whereby erroneous TBs were identified using a climatology check
  - A moving data window was used to seek long sequences of scans where this behavior was detected

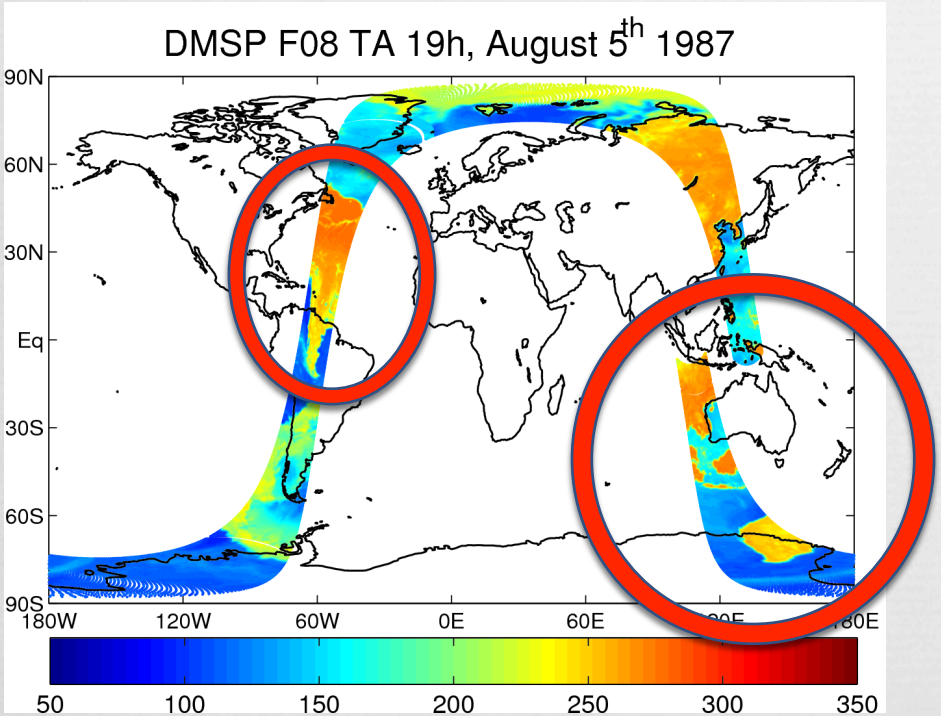
# Methods

- Three parameters are used in the QC check:
  - Number of pixels in a scan that are more than three standard deviations from the climatological mean
  - Number of scans in the data window exceeding this threshold
  - Width of the data window
- The three parameters must be chosen with great care
  - Must avoid incorrectly flagging "extreme" weather phenomena that fall outside the climatology check as bad scans
- A large number of cases were studied in order to ensure that the new QC check worked appropriately

# Analysis

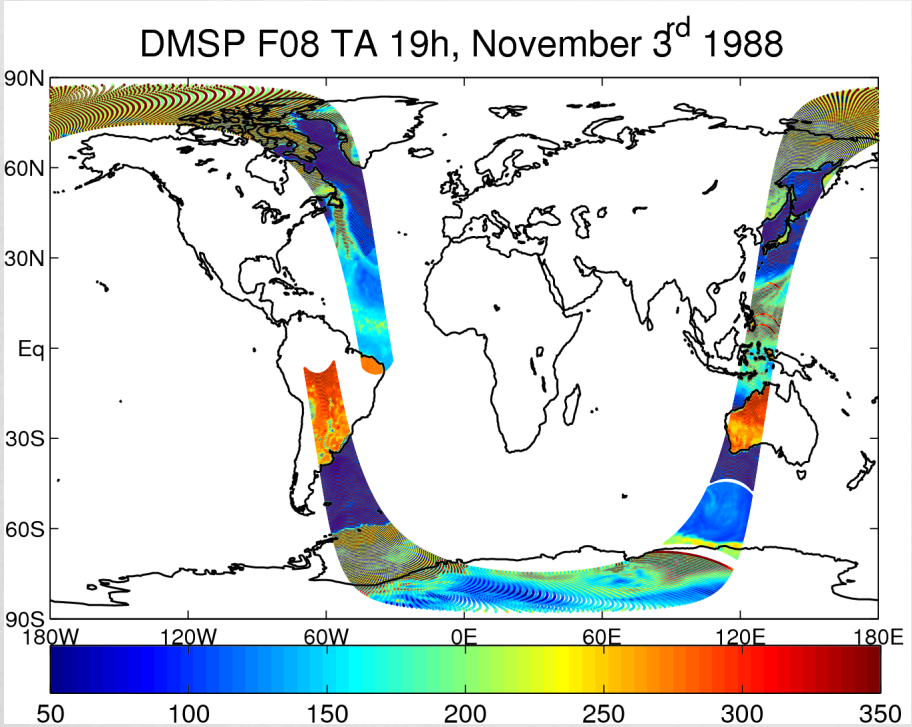
- Three flavors of cases
- 1. Time Geolocation Error
- 2. Alternating Scan Error
- 3. Climatology

# Problem 1: Time Geolocation Error



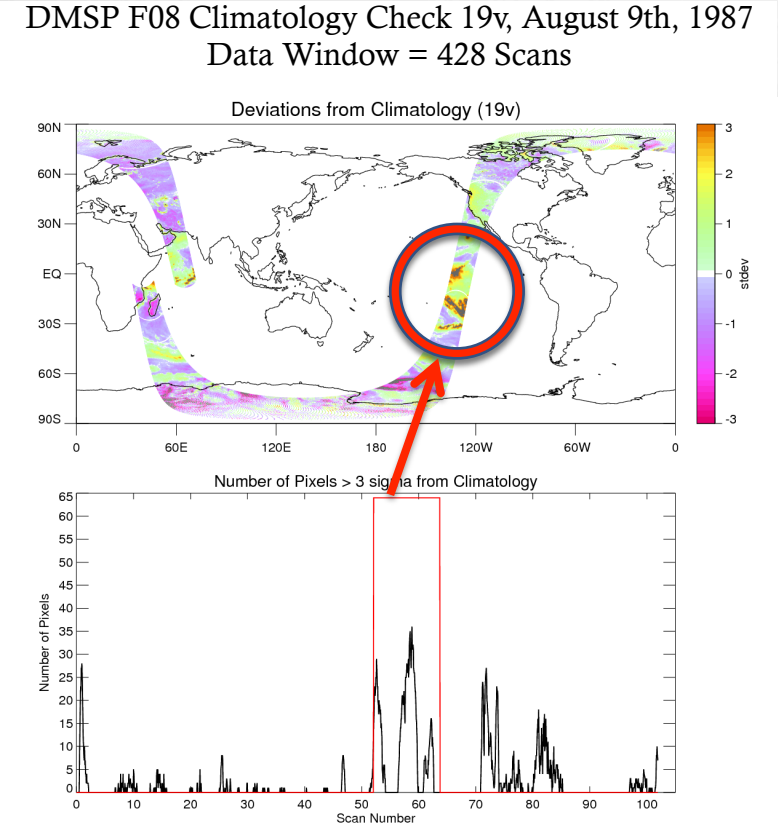

- The geolocation was determined to be correct for the original time
- Time and TB values in the file did not match
  - the data are incorrectly geolocated
- Window argument was carefully chosen to ensure bad scans were removed
- Window needed to be long enough to span areas where ocean TB values were incorrectly placed over ocean (the wrong ocean) and passed the climatology check but were actually erroneous
- Same was true for land pixels

# Problem 2: Alternating Scan Error




- Some swaths contained good scans that were interleaved with bad (presumably mis-located) scans
- These "good" scans caused the QC check to miss the bad scans when the bad scans occured in smaller chunks
- A wider time window was used to ensure that these scans were flagged

# Problem 3: Climatology



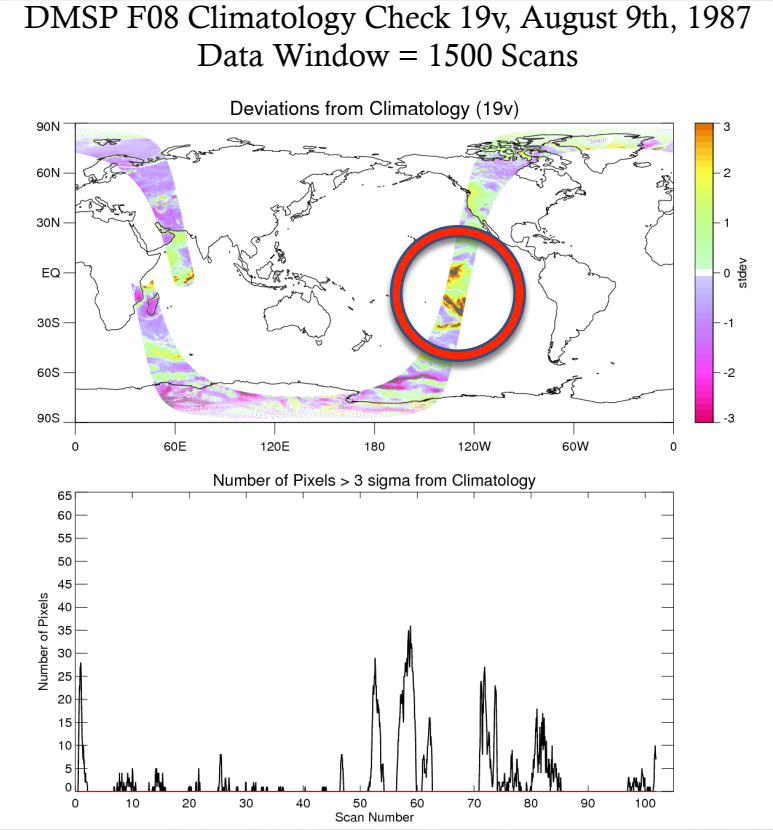

- Biggest danger of implementing this type of QC check
  - Potential for incorrectly identifying weather phenomena as bad pixels
- Climatology check of three standard deviations was used
- TBs showing large weather variations are routinely identified as bad in two main categories
  - Significant weather phenomena over oceans and land
  - Sea ice over the Arctic Southern Oceans and Antarctica snow cover
- Case studies where used to ensure that the QC check does not identify such cases as bad
- Solved by using a window that was long enough to span over such weather/surface phenomena

# Results

- The new screening procedure for removing bad scans due to mis-matched time data was tested an implemented for F08
- Testing was conducted to ensure that the screening procedure did not remove large weather events that were outside the three sigma climatology
- This testing mainly focused on what size window was required to effectively pass over these extreme weather events
- The final QC check was implemented with the following settings:
  - If 30 pixels in a scan fail the three sigma climatology check, that scan is potentially bad
  - If the percentage of potentially bad scans within a window was greater than 30%, those scans were flagged as actually bad
  - The final window size was chosen to be 1500 scans (~100 minutes)

# Results

- A further test of the technique was done by applying the procedure to F13, which is known not to have this problem
- It was found that the window of 1500 scans did not exclude genuine weather events for F13, but did exclude erroneous pixels for F08
- The procedure was applied to F08, F10 and F11



# Summary

- Adequate quality control of the F08 SSM/I data is of great importance to the longer SSM/I climate record since this one sensor extends the series by around five years
- Substantial errors exist in the raw F08 temperature data record that preclude their use for climate studies without the application of QC procedures
- A QC procedure has been developed and implemented for F08 that removes a significant number of bad scans
- The QC issues were a larger problem than the intercalibration of the satellites and thus applying the QC checks has lead to a large improvement in the climate data record

# Credits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# QUESTIONS?