A Web-Based Interface for the Topex Microwave Radiometer Climate Data Record

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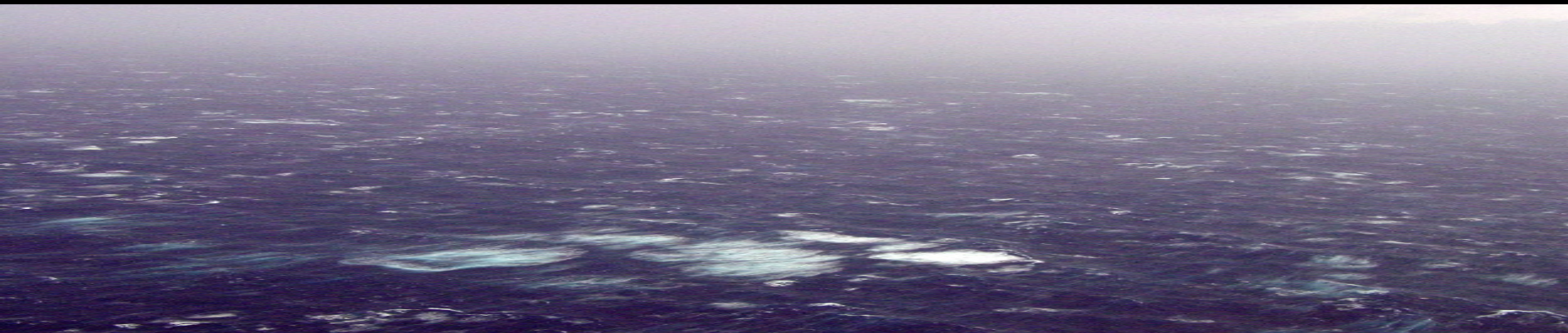
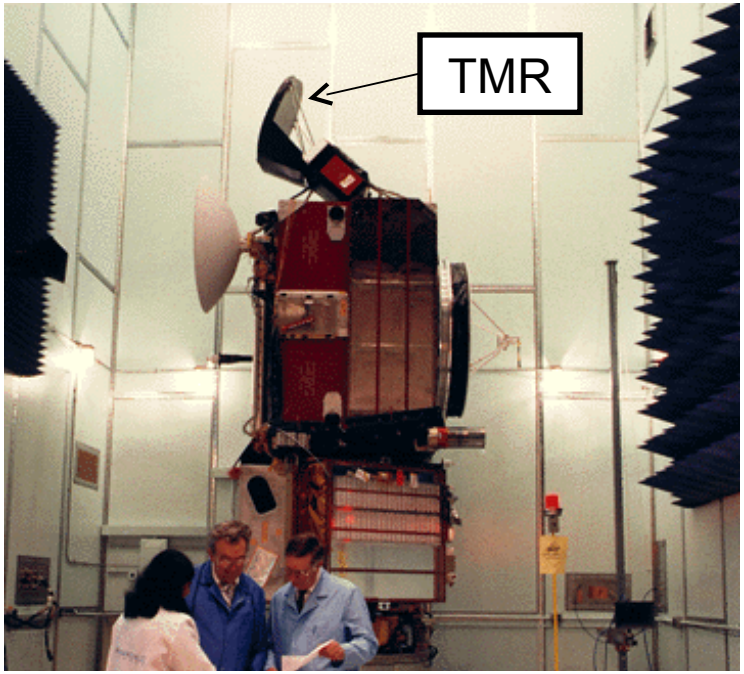


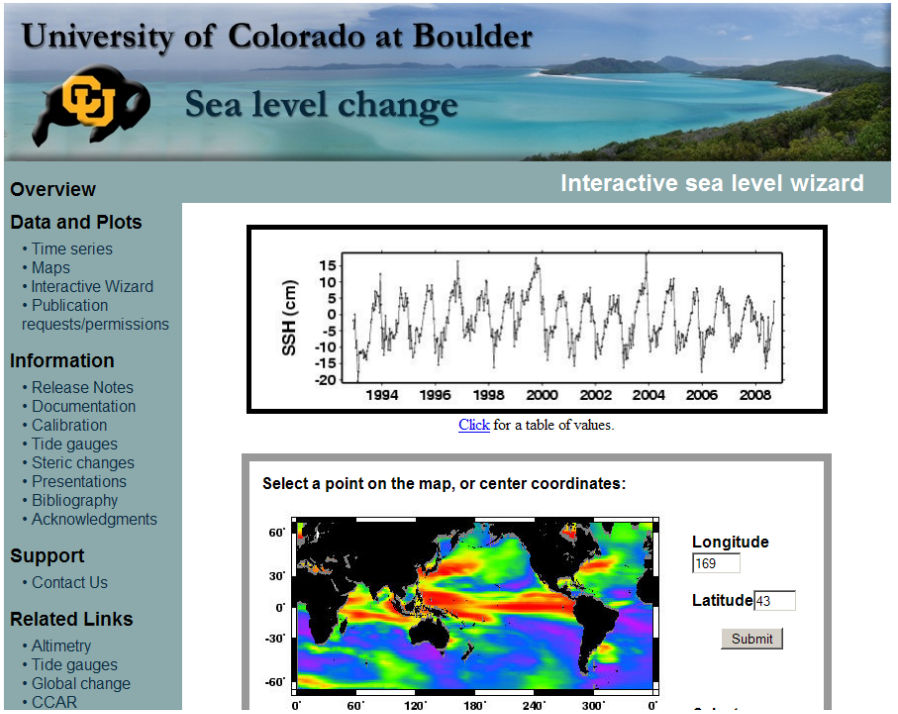
Introduction

- Topex Microwave Radiometer (TMR) on Topex/Poseidon Ocean Altimetry Satellite to measure wet tropospheric path delay (PD)
- Collected data from September 1992 to October 2005
- 10-day exact repeat orbit, covering ±66 degrees latitude
- TMR measured brightness temperature at three frequencies: 18.0, 21.0 and 37.0 GHz
- Retrieval products: wind speed, integrated water vapor, integrated cloud liquid water



TMR Climate Data Record

- Water vapor and clouds play an important role in the Earth's climate system
- The 13-year TMR climate data record produced from a single sensor is valuable for climate research
  - Observing climate variability
  - Validating climate models
  - Comparing with other climate data records
- **TMR data currently under-utilized by non-expert users (e.g. climate scientists)**
  - **Data not easy to access, only exists in binary ocean altimetry data products**



Topex Altimeter data web interfaces available for studies of sea level climate variability

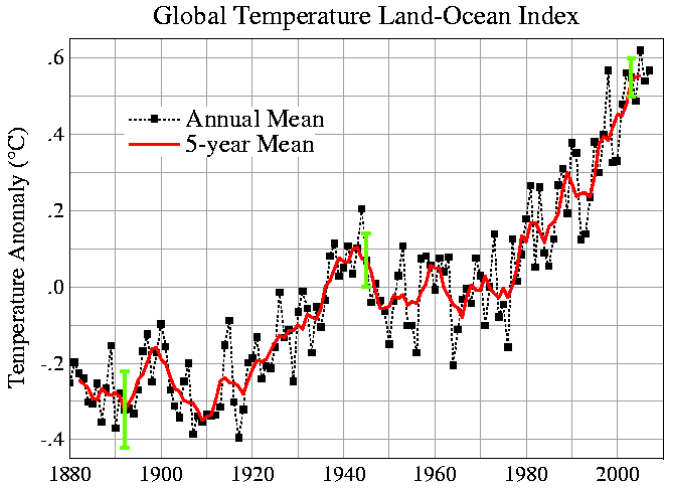
Project Overview

- The goal of this project was to provide climate scientists with easy data access and visualization tools via a web based user interface

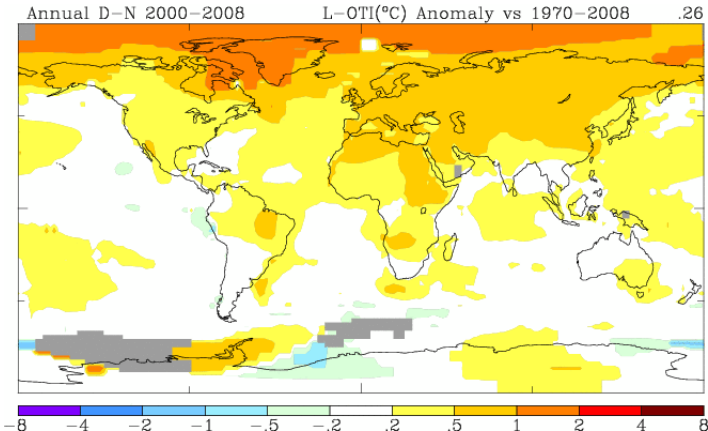
- Site provides data visualization tools (maps, graphs) based on what climate scientists are used to working with
  - Line graphs, trends, relative line plots
  - Mean maps and anomaly maps

- Site also provides raw data (ASCII) files for more expert users

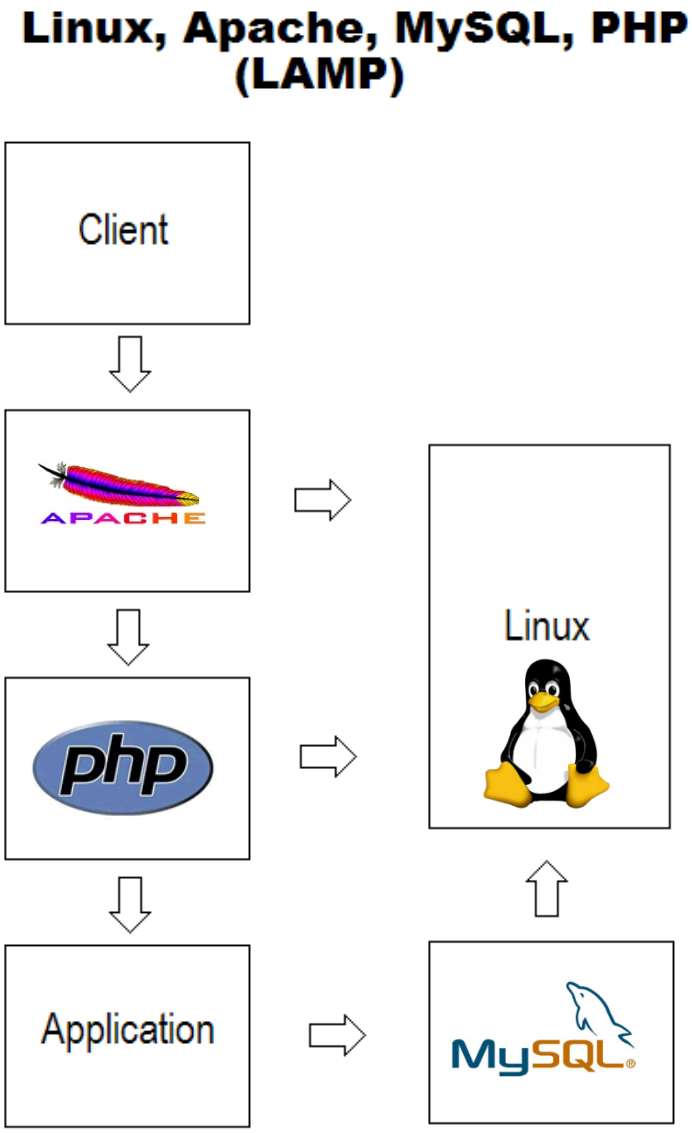
Temperature Trend Plot from GISSTEMP: Shows Varability Over Time



Temperature Anomaly Map from GISSTEMP: Shows Regional Variability

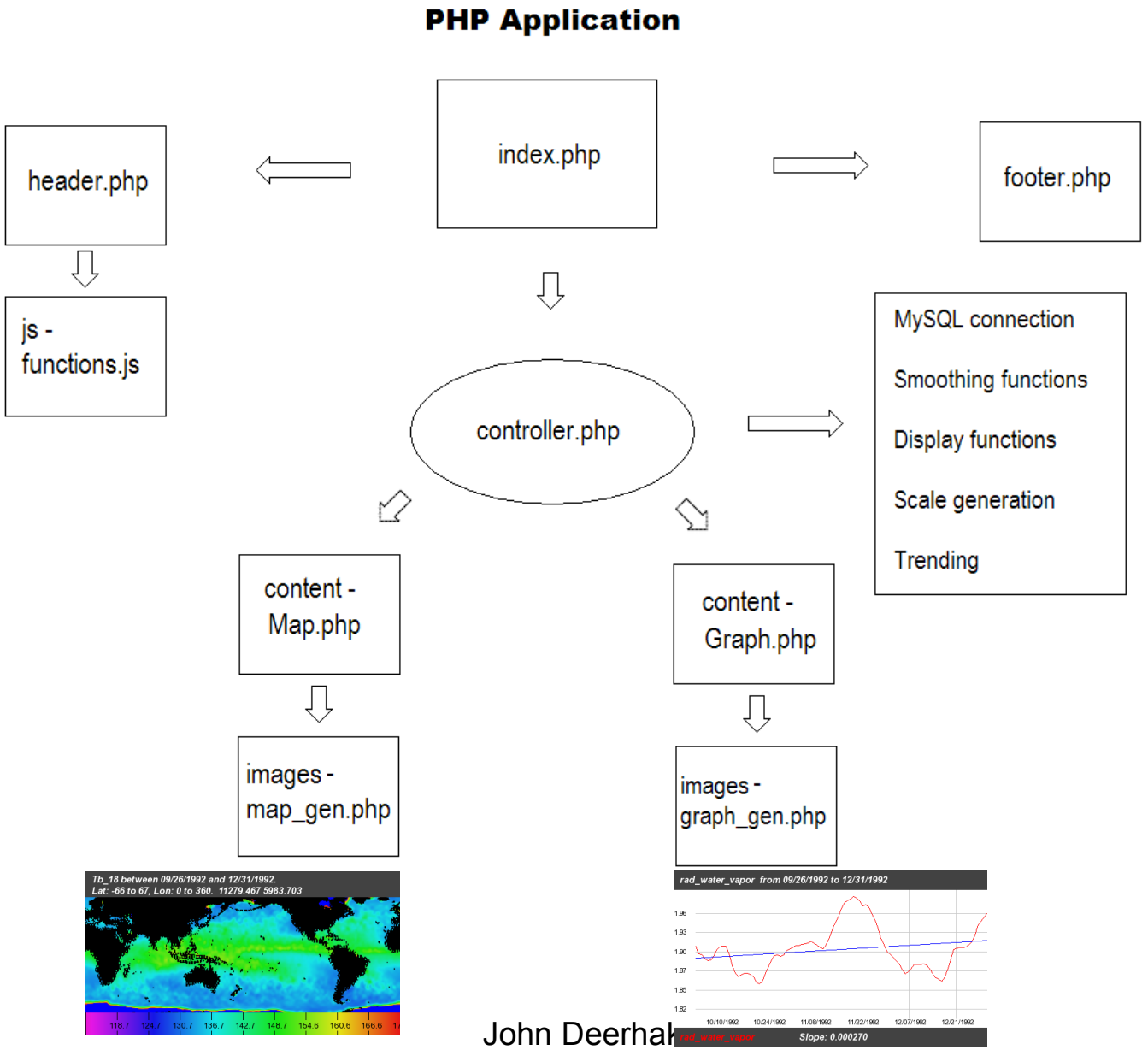


Server System

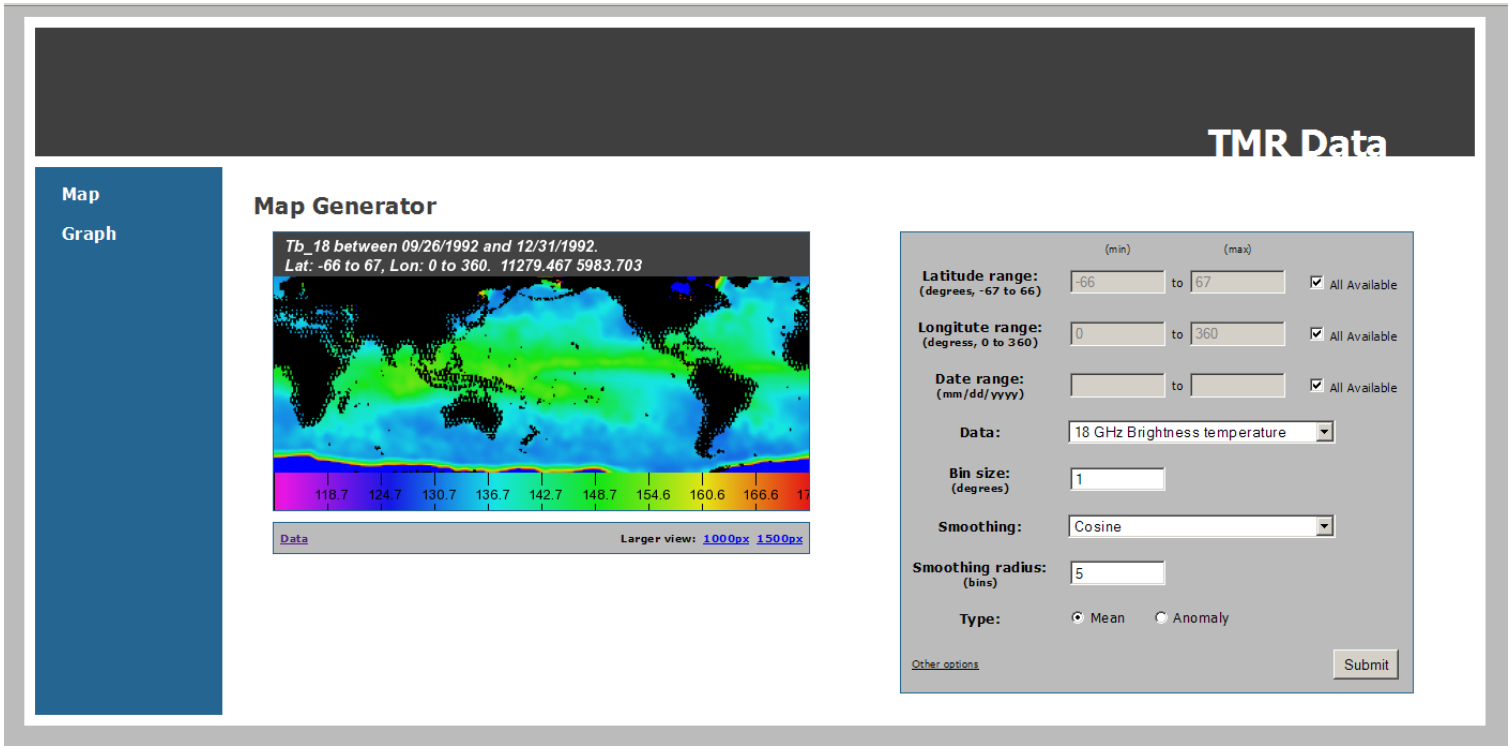


- Solution stack for an application server
- Very widely used to host dynamic web sites
- Facebook, Digg, Wordpress, OSU.edu, etc.

Application



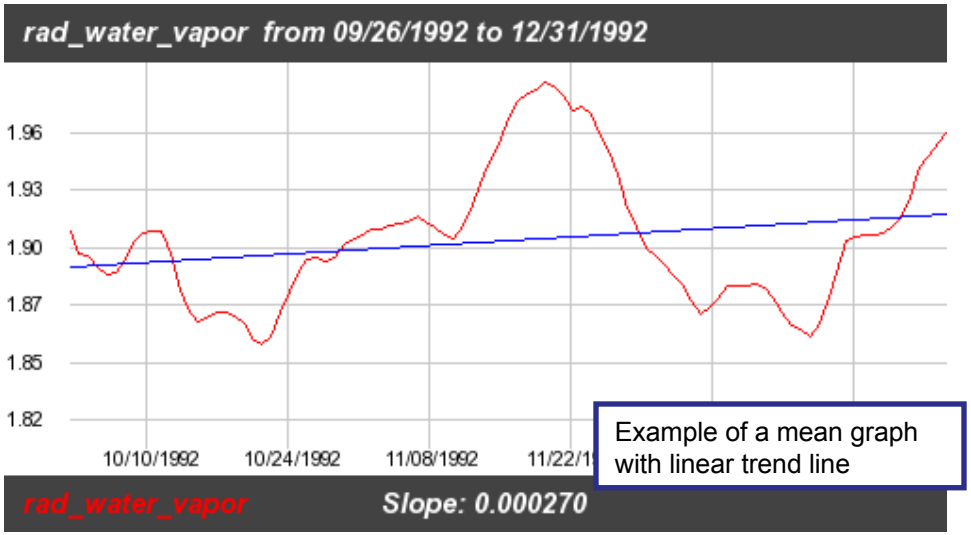
Site Design

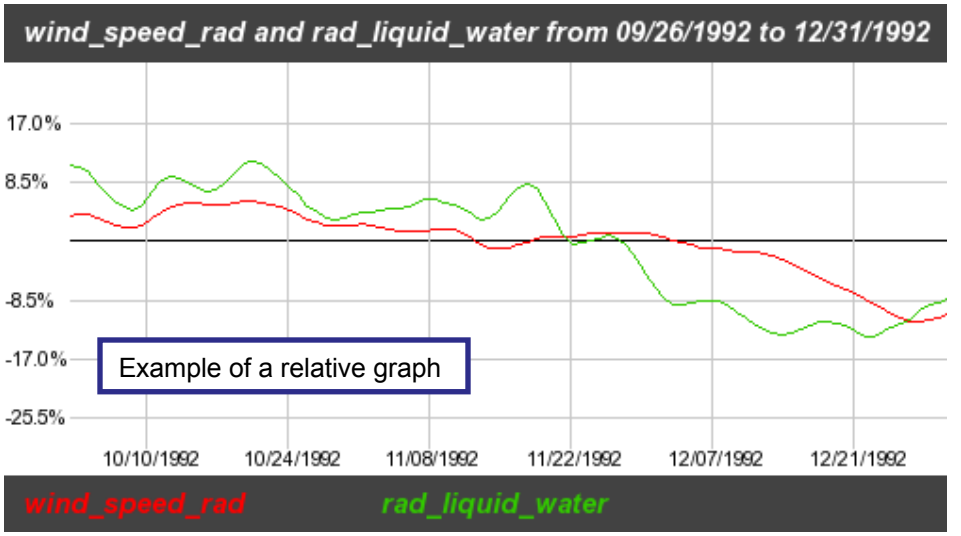


- Simple, clean design
- Intuitive
- Uses site-wide cascading style sheet
- Universal browser compatibility (almost)

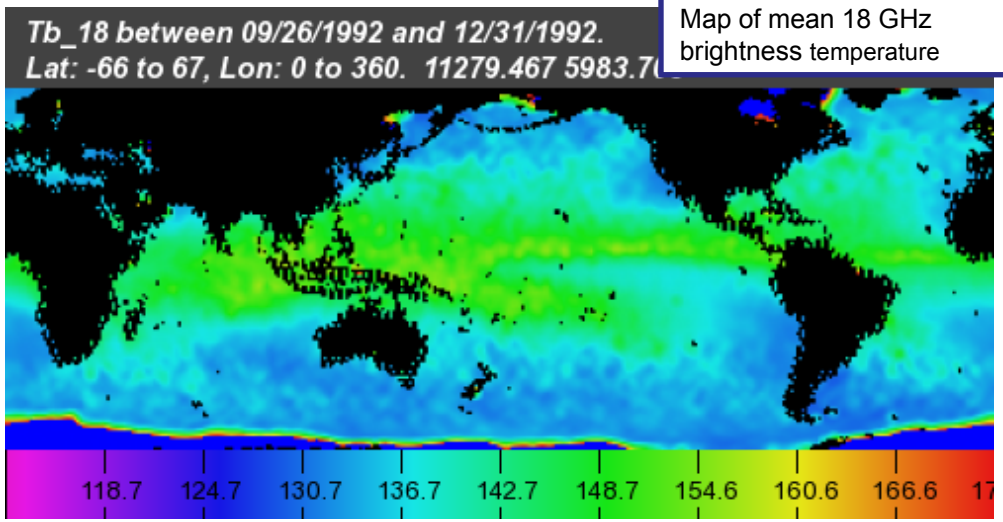
Graphing Data

- Mean and relative graphs
- Adjustable timeline, automatically generated scale
- Boxcar and cosine smoothing
- Linear trending with slope value
- Adjustable resolution and ability to view raw data

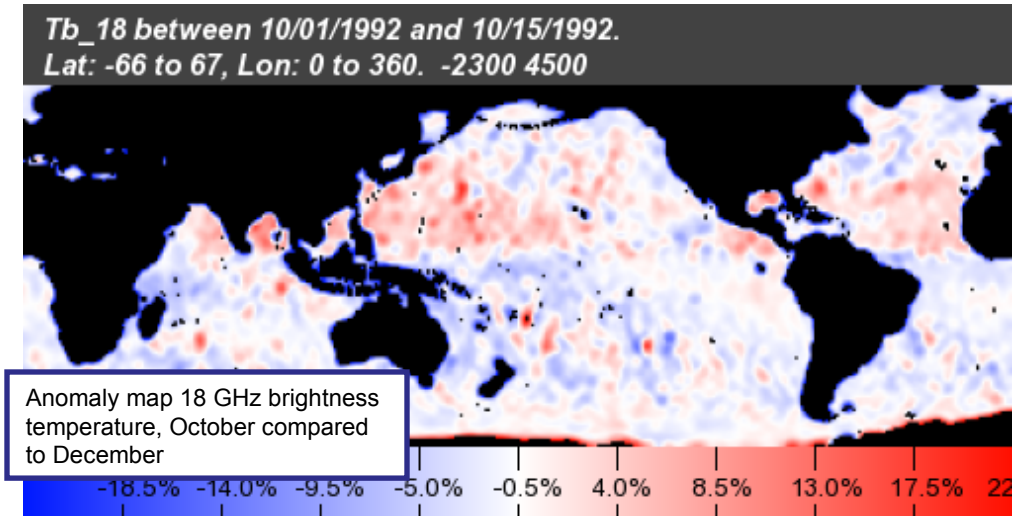




Mapping Data



Map of mean 18 GHz brightness temperature



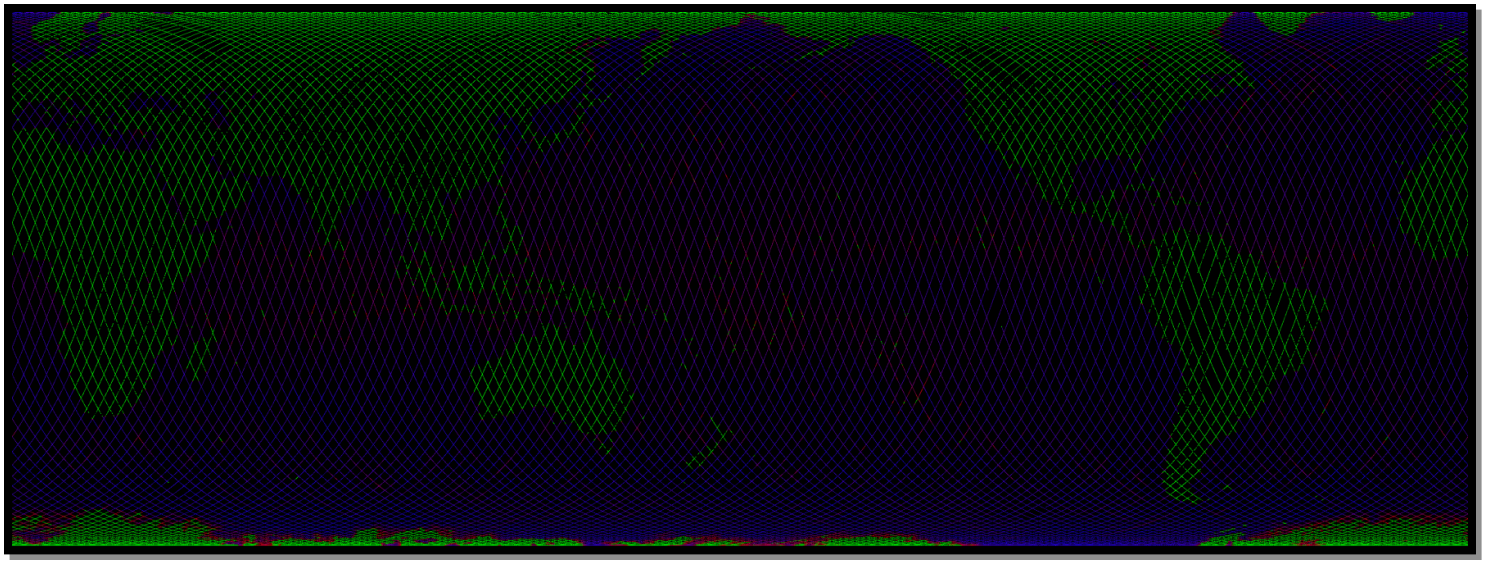
Anomaly map 18 GHz brightness temperature, October compared to December

- Mean and anomaly maps
- Adjustable timeline and geography
- Automatically generated scale
- Boxcar and cosine smoothing with adjustable radius
- Option to view raw data

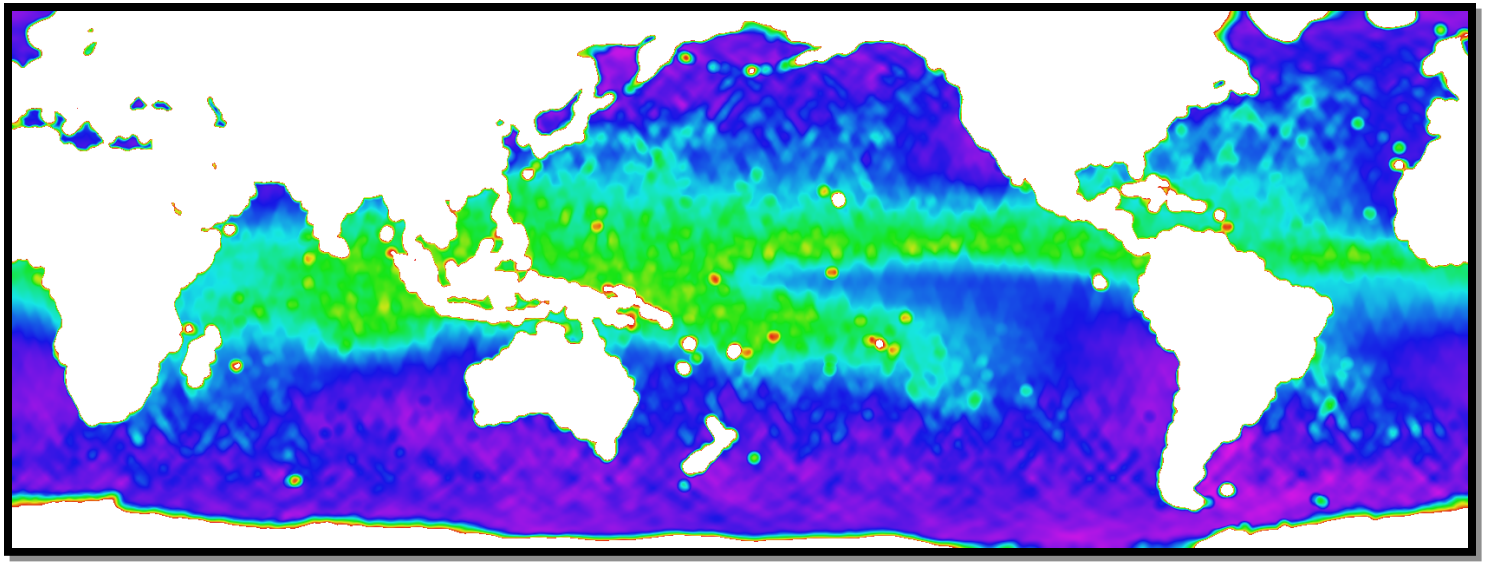
Map Smoothing

Tb_18 from 9/26/1992 to 12/31/1992

- Unmodified data
- TMR is non-scanning, only observing along track
- Creates gaps in coverage



- Smoothed Data
- Cosine smoothing at a 2.5° radius
- Gives a clearer representation of the data



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Database

- MySQL database
- Extremely popular database technology for web applications
- 1 table with 18 fields
- Raw TMR data accounts for over 340 million entries
- Makes for slow query times and excessive memory usage

- Sampled into much smaller database by using 1 degree/ 1 day bins
- Now approximately 7 million rows
- Negligible loss of useful information for climatology

Future Expansion

- Many possible ways to expand the site
- Increase code efficiency
- Add new data visualizations
- Add data from additional instruments and models
- Ability to overlay line graphs
- Feedback and suggestions from users

Conclusion

- TMR data is scientifically valuable but currently under-utilized
- This system allows for easy access to the TMR climate data record by non-experts
- System is mature and ready to go live