Validation of Near-Real Time Diurnal Warming Estimates Using Geostationary Data

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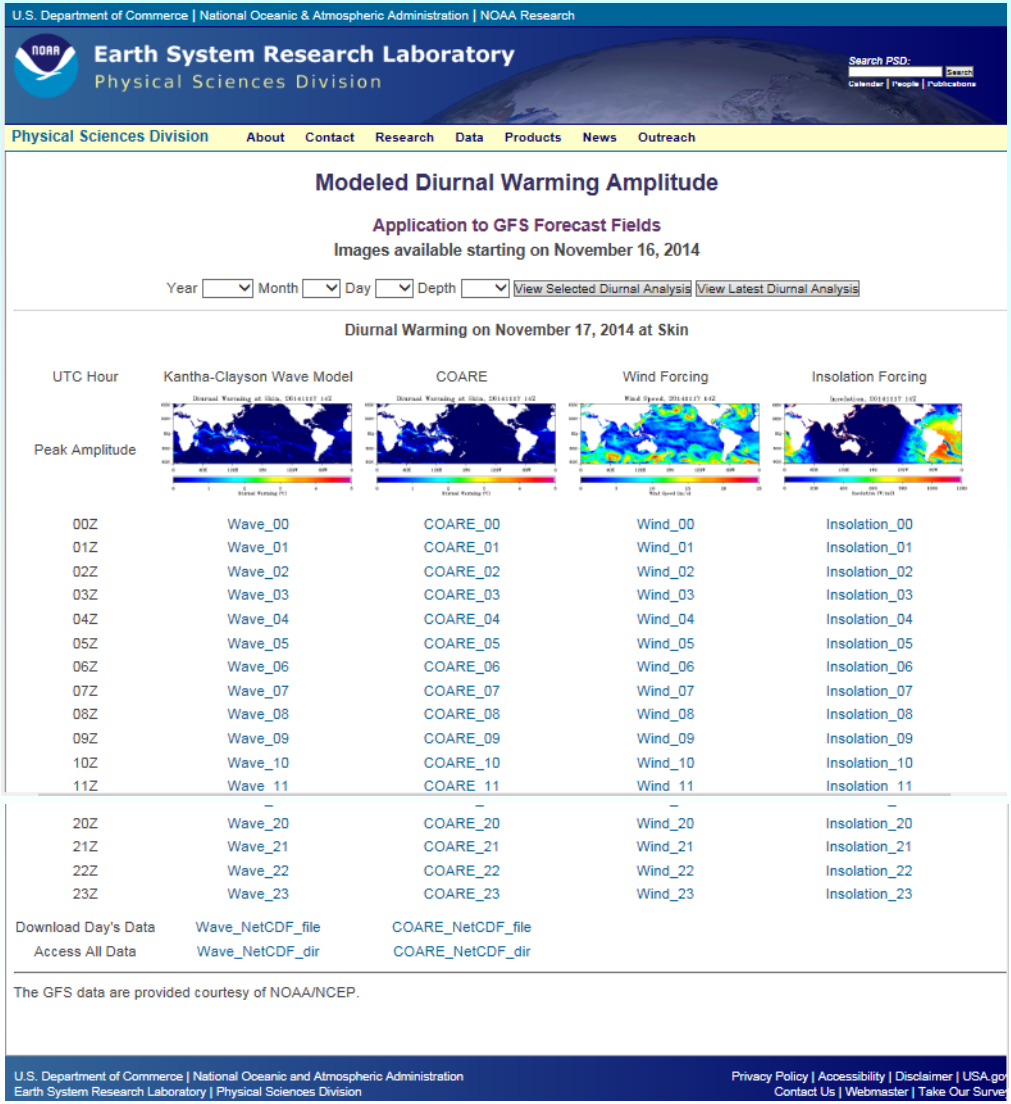
Outline

- Motivation
- Description of observed and modeled diurnal warming products
- Validation results
- Conclusions

Motivation

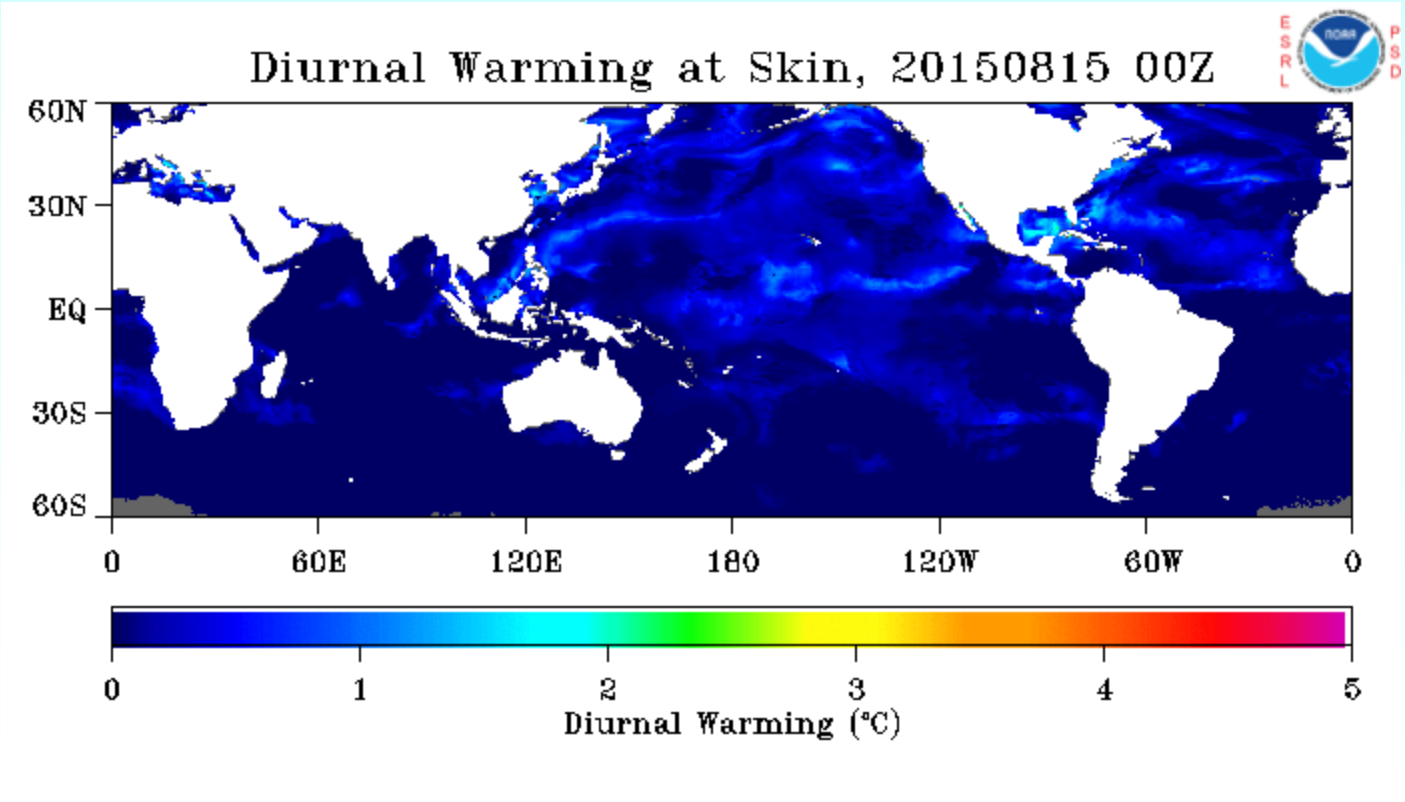
- Diurnal warming estimates/analyses desired to complement foundation analyses
- Near-real-time capability to model diurnal warming based on numerical weather prediction products has been implemented
- Detailed validation of modeled diurnal warming required



Model Characteristics

- Kantha-Clayson model with wave effects
- Inputs
  - GFS analysis fields, 6 hourly, 0.5°
  - Wave Watch III Wave Model
- Diurnal warming computed hourly at multiple depths
  - Fluxes interpolated to model time step
  - Model run globally for 2 days with output taken from the second day
  - Warming estimated as instantaneous subskin – 5 m depth
  - Running daily since last July

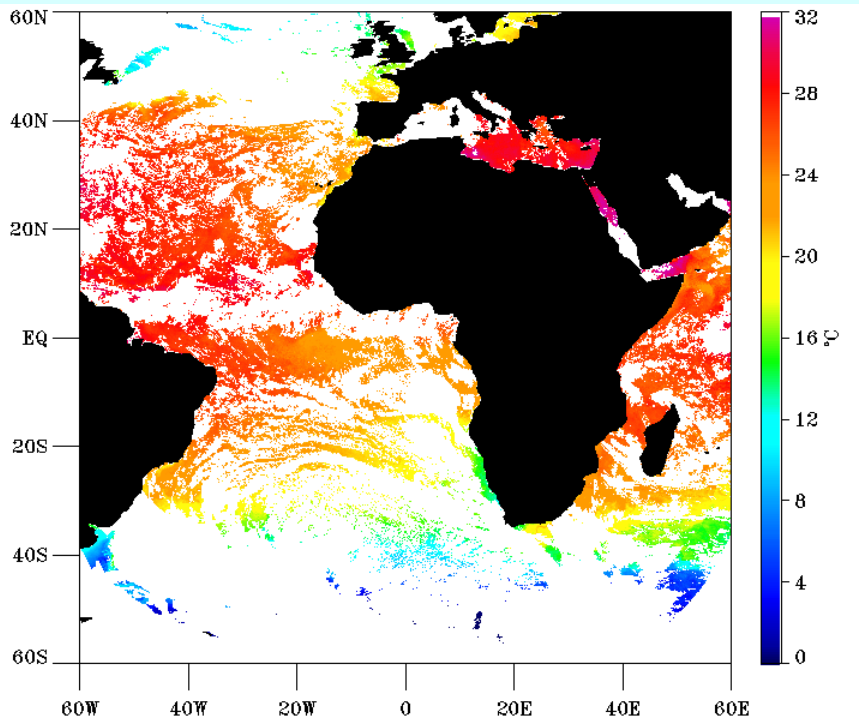
Example Modeled Diurnal Warming



SEVIRI-Derived Diurnal Warming

- Source: Hourly 0.05° data provided courtesy IFREMER
- Hourly diurnal warming computed as hourly SST minus foundation estimate
- Highest confidence data only

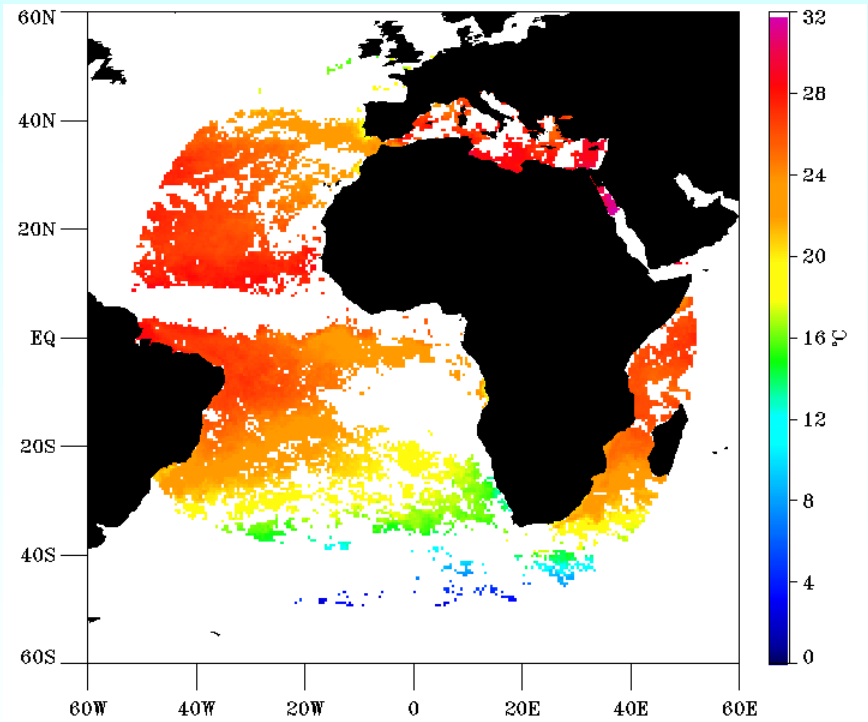
IFREMER 1-hr SEVIRI SST Product
1400 UTC, August 15, 2015



SEVIRI Foundation Product

- Produced at 0.5° resolution
  - Match to resolution of modeled diurnal warming
  - Enables increased data density
- Daily estimates derived from nighttime observations between 00 and 06 LST
  - Hourly median over 10x10 array of full resolution
  - Mean of values from hourly scenes
- Running 5-night centered median

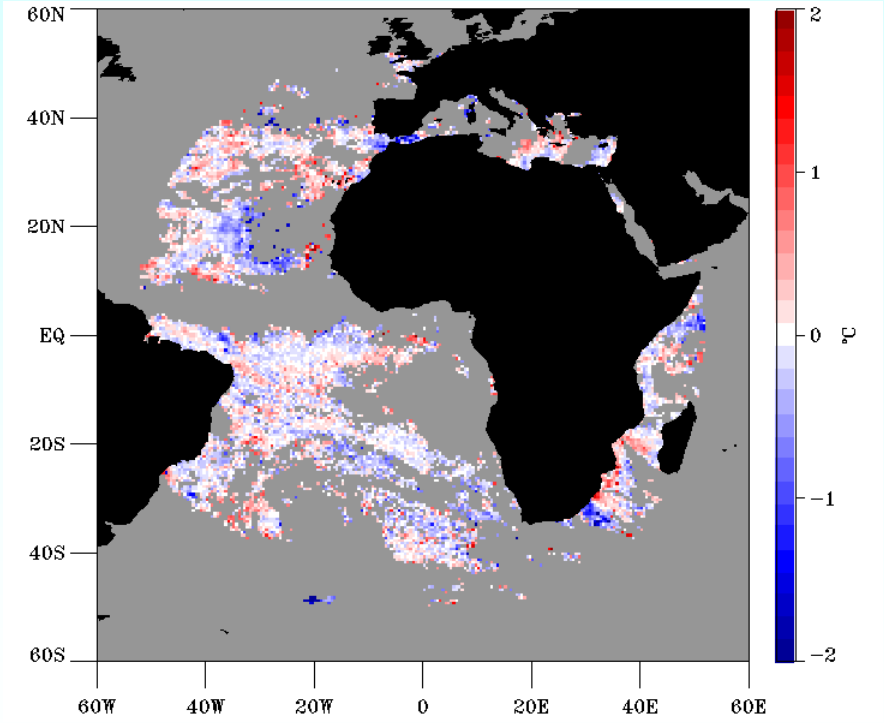
Derived SEVIRI Foundation SST
August 15, 2015



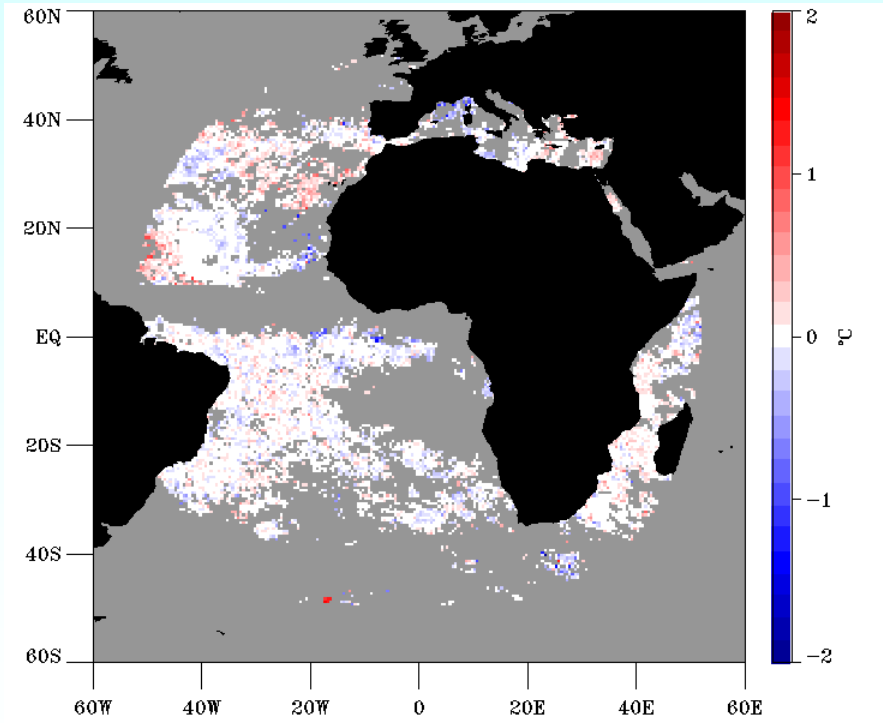
Why Multiple Nights?

SEVIRI Foundation Difference: August 16 – August 15, 2015

Single Night Foundation



Smoothed Foundation



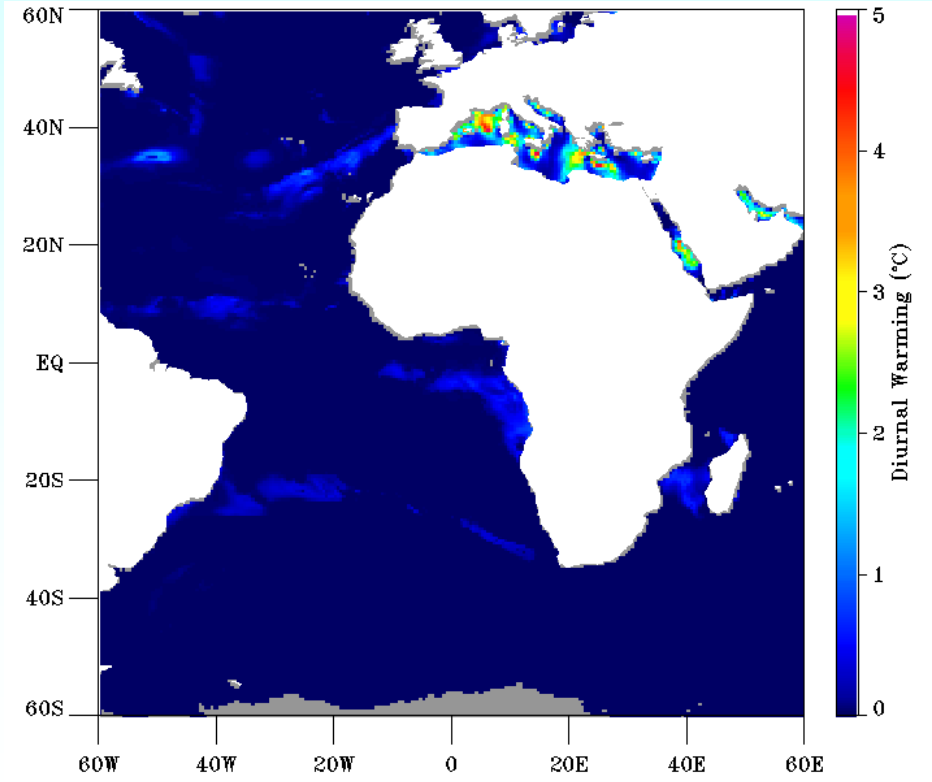
Model Validation

- Qualitative visual comparisons
- Comparison of distributions of diurnal warming
  - Compiled hourly
  - Monthly and seasonal accumulations
  - Generated only for coincident points
- Direct comparison of coincident values

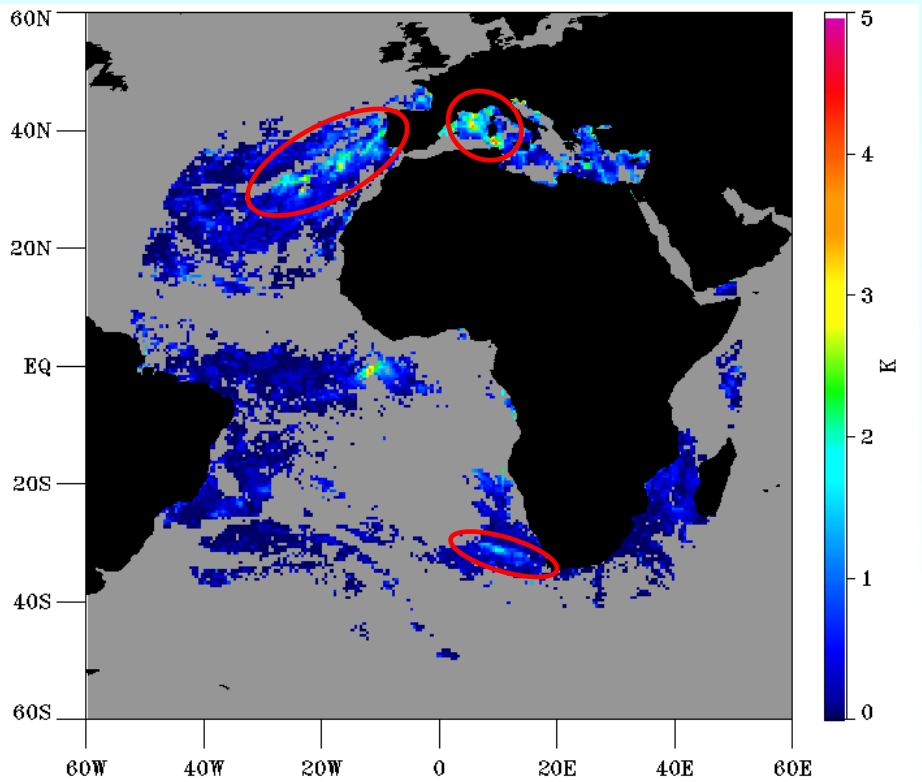
Visual Warming Comparison

August 5, 2015, 1400 UTC

Model



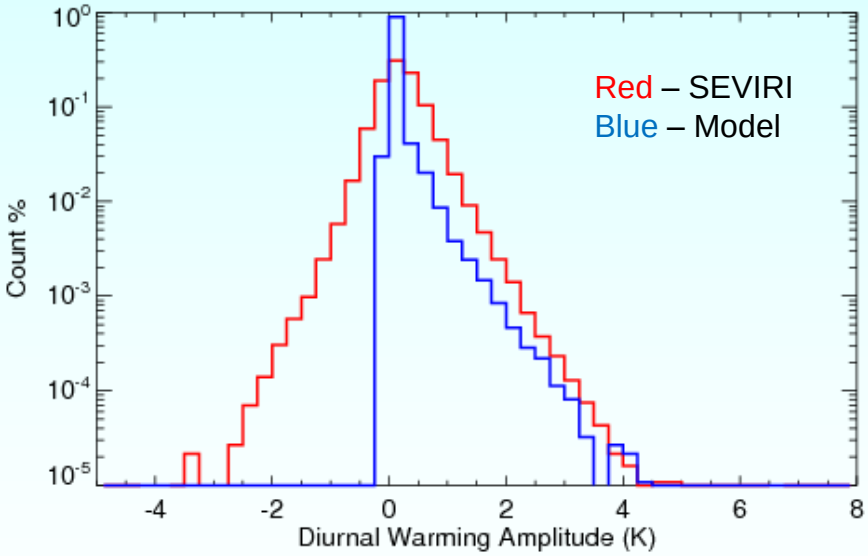
SEVIRI



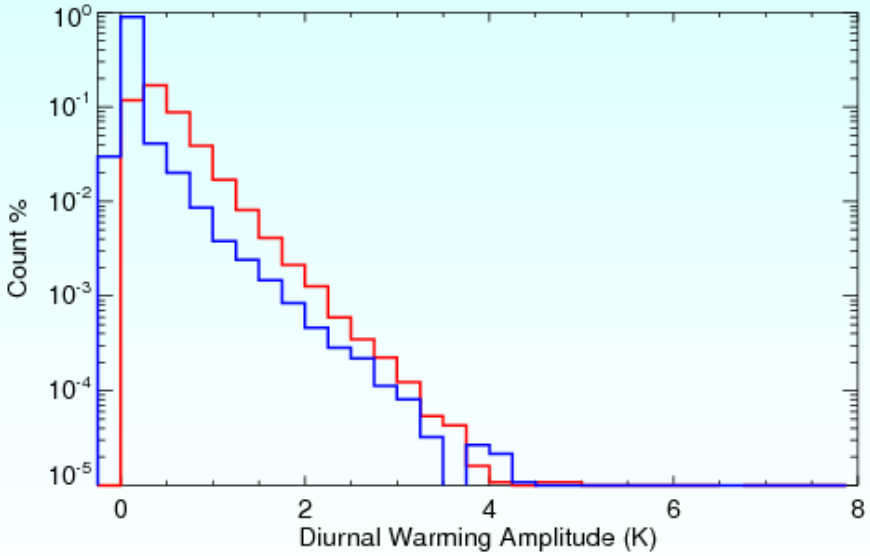
Comparison of Distributions

March 2016, 1400 UTC

Original



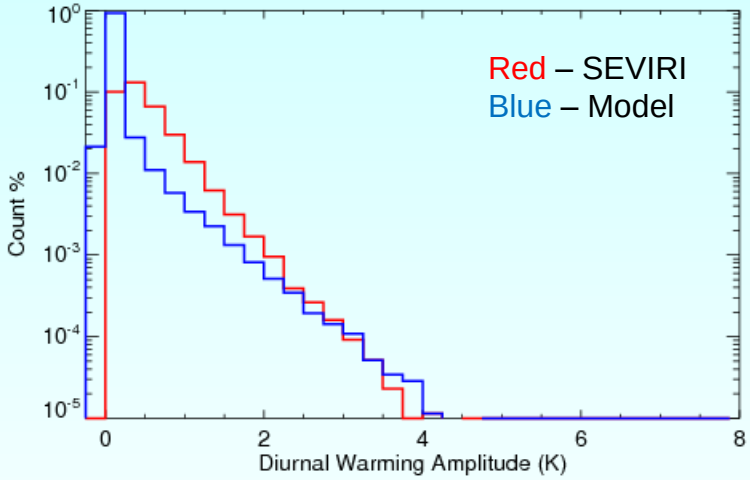
Adjusted



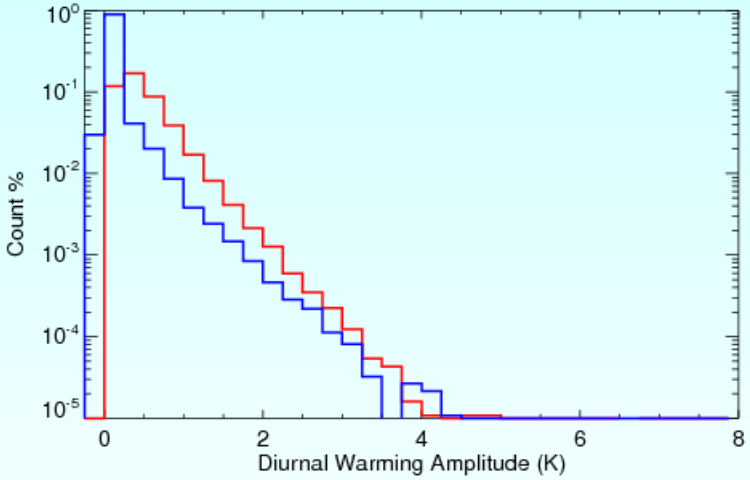
Comparison of Distributions

March 2016

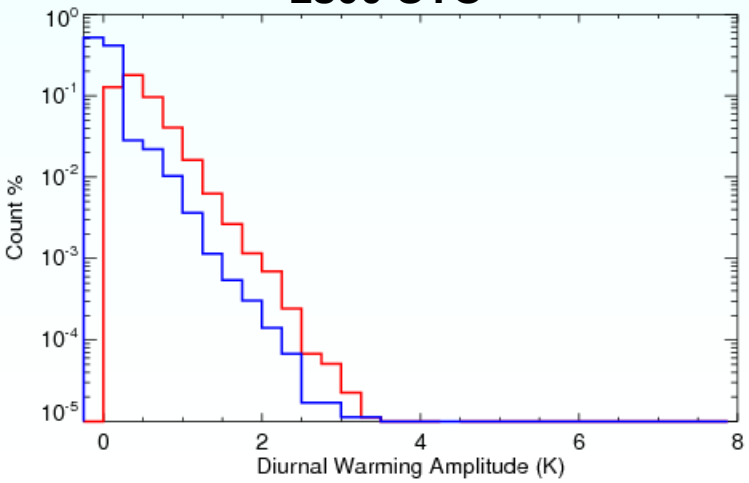
1200 UTC



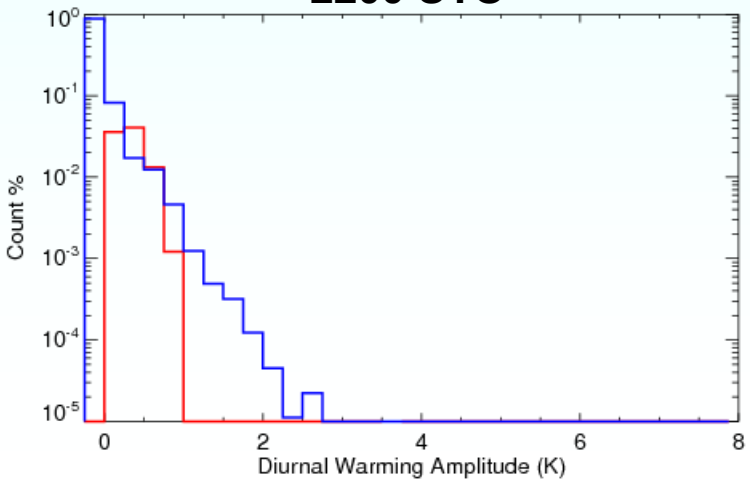
1400 UTC



1800 UTC

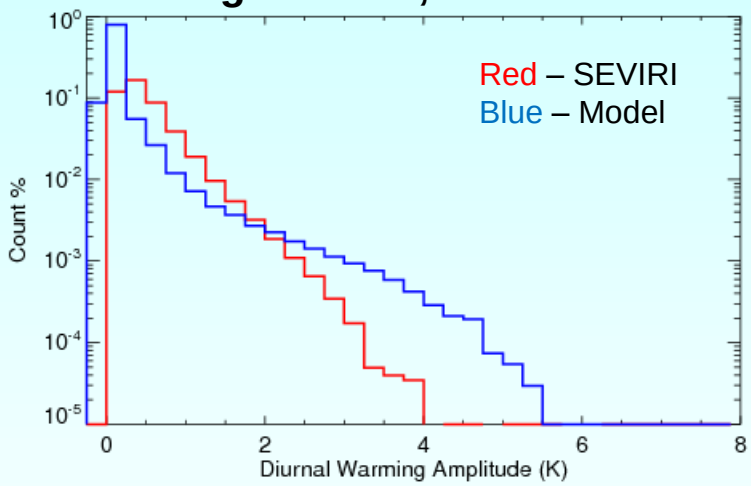


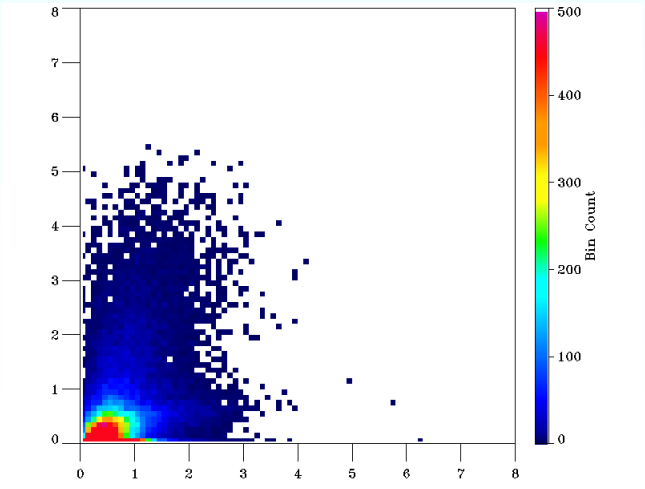
2200 UTC



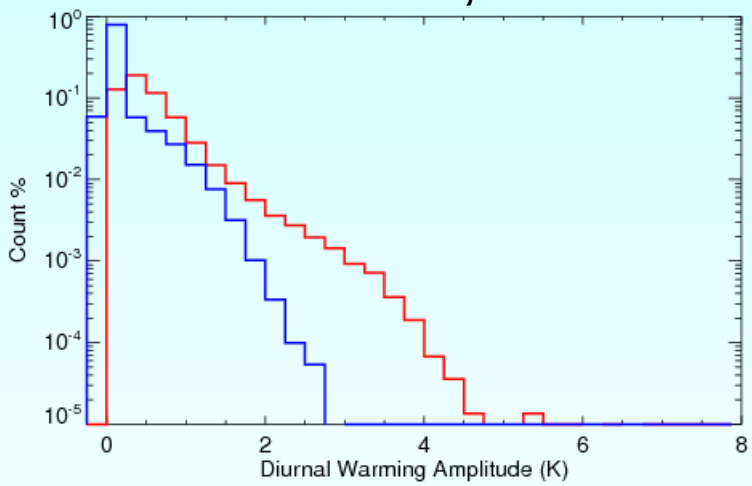
Seasonal Comparison

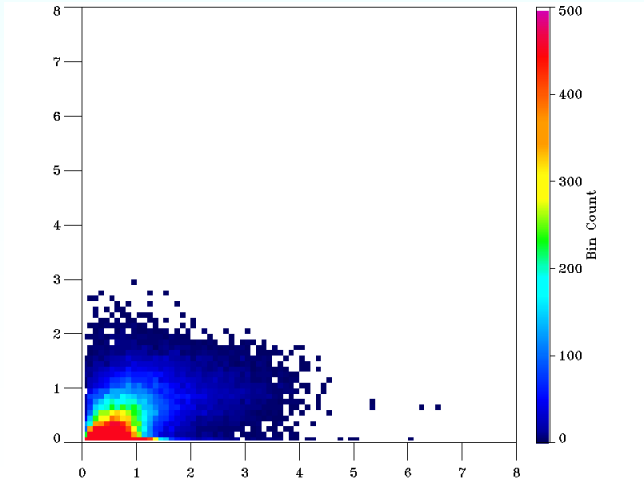
August 2015, 1400 UTC





December 2015, 1400 UTC

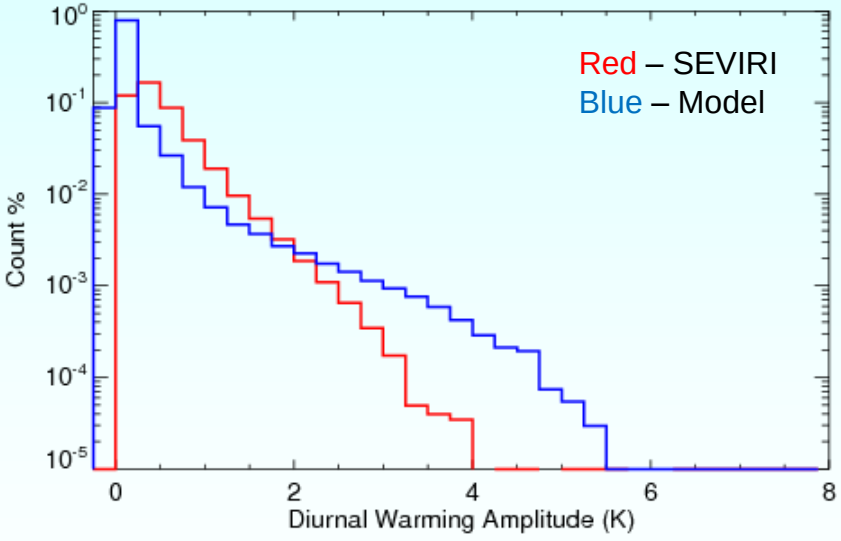




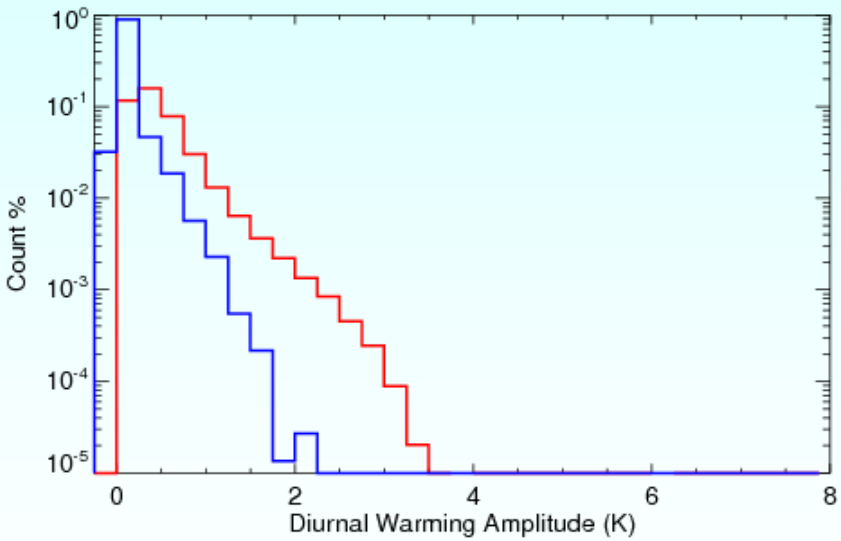
Effect of Missing Wave Data

August 2015, 1400 UTC

Including the Mediterranean



Excluding the Mediterranean

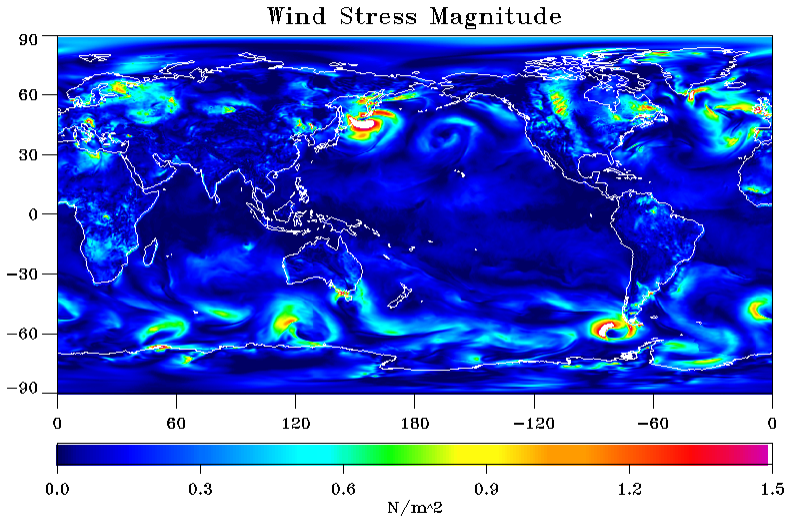


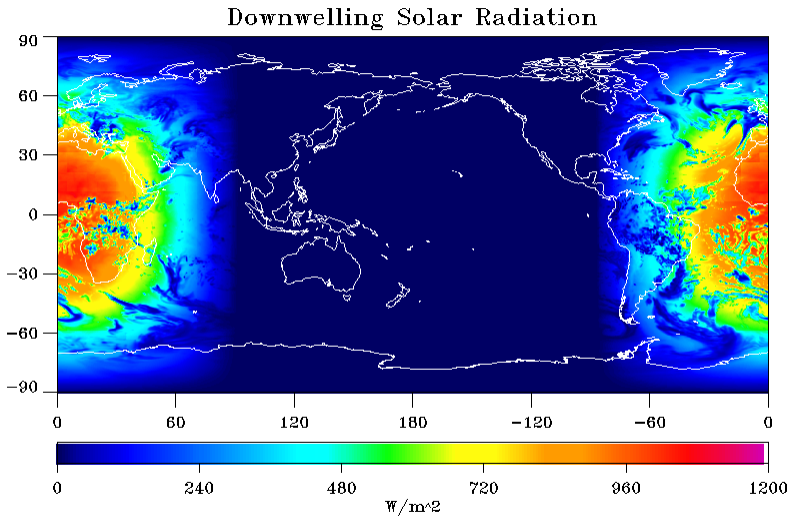
Conclusions

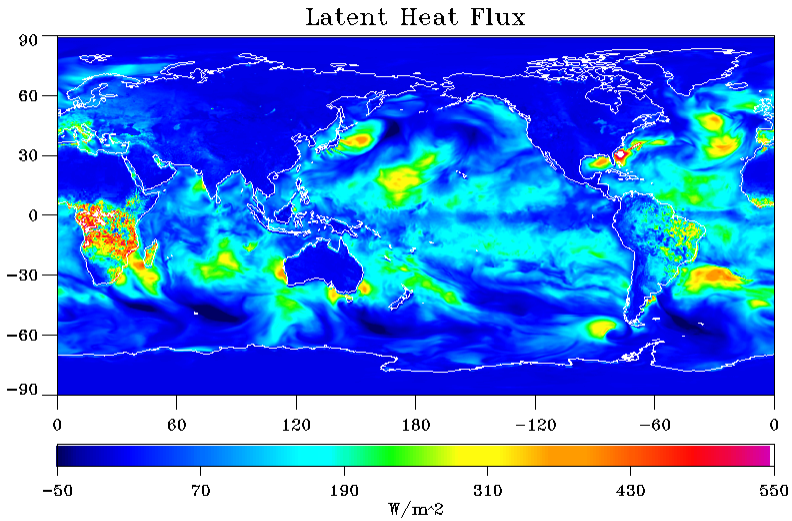
- Geostationary data highly valuable for validation of diurnal warming estimates
- Validation must encompass multiple regions and seasons
- Inclusion of wave effects having a significant impacts on modeled diurnal warming
- More model refinements required to accurately treat conditions with and without wave data

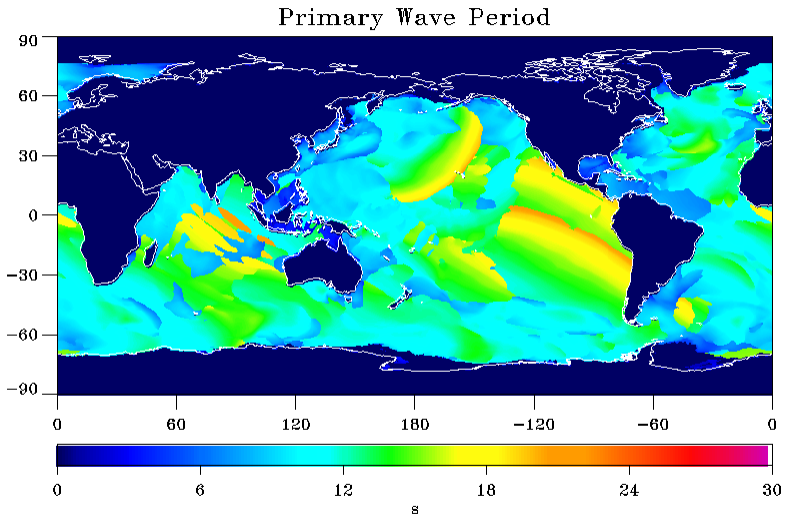
Sample Model Forcing Fields

21 March 2013, 1200 UTC



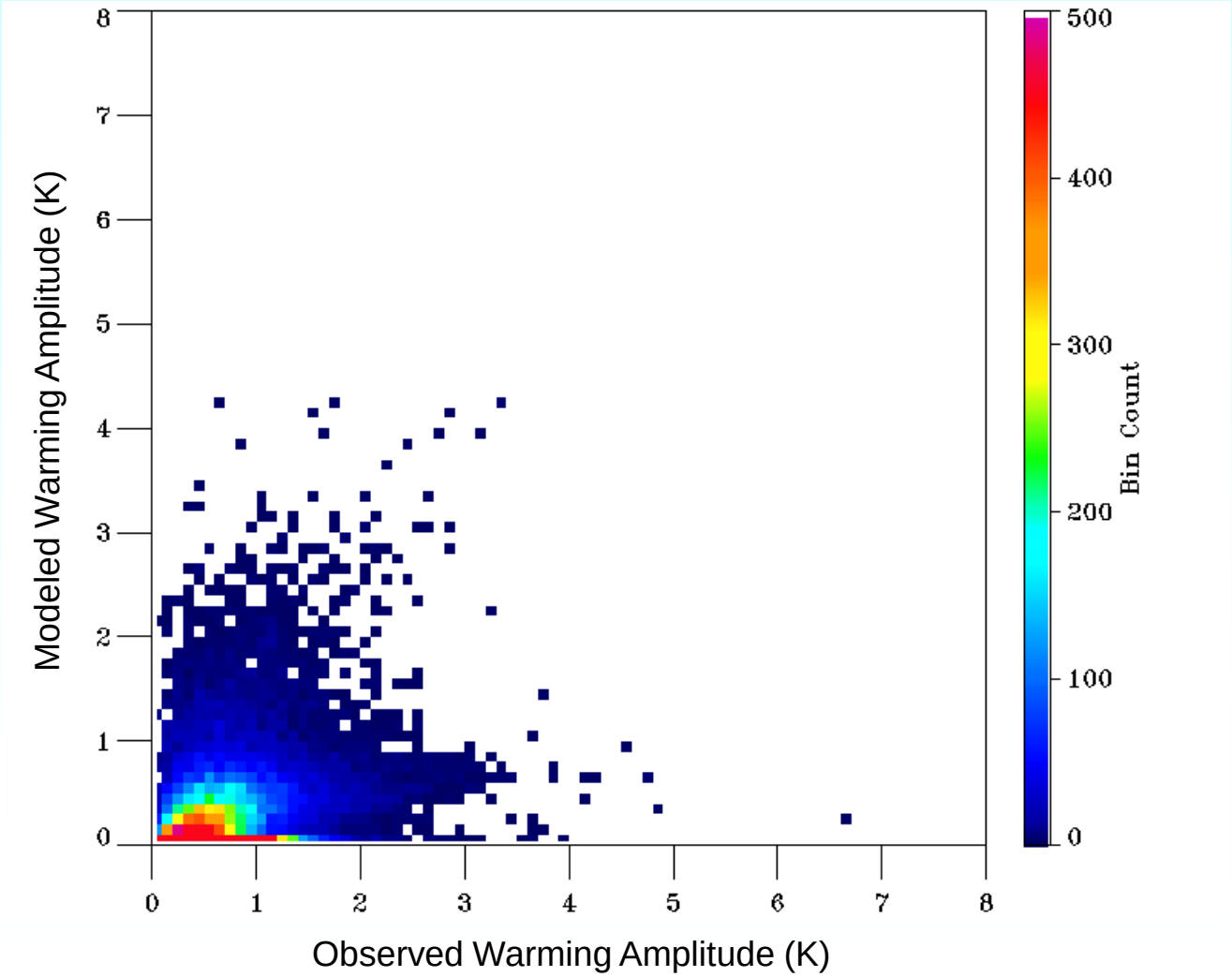






Direct Comparison of Warming Estimates

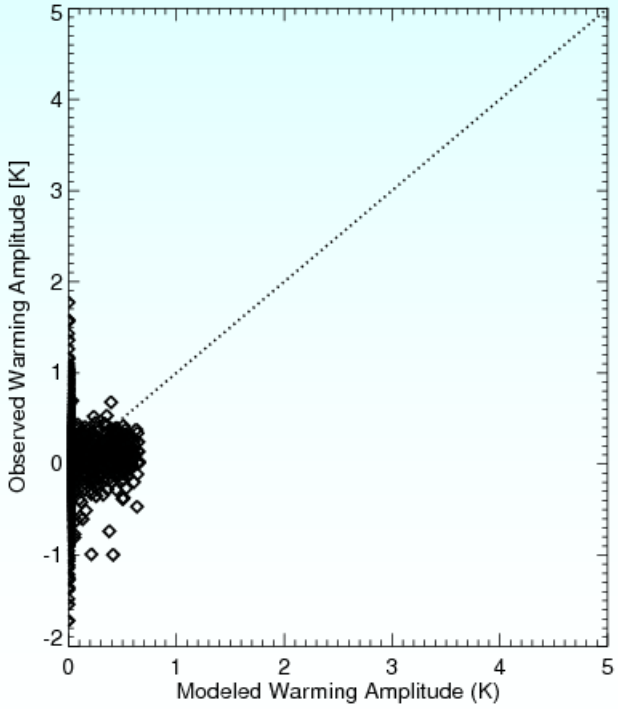
March 2016, 1400 UTC



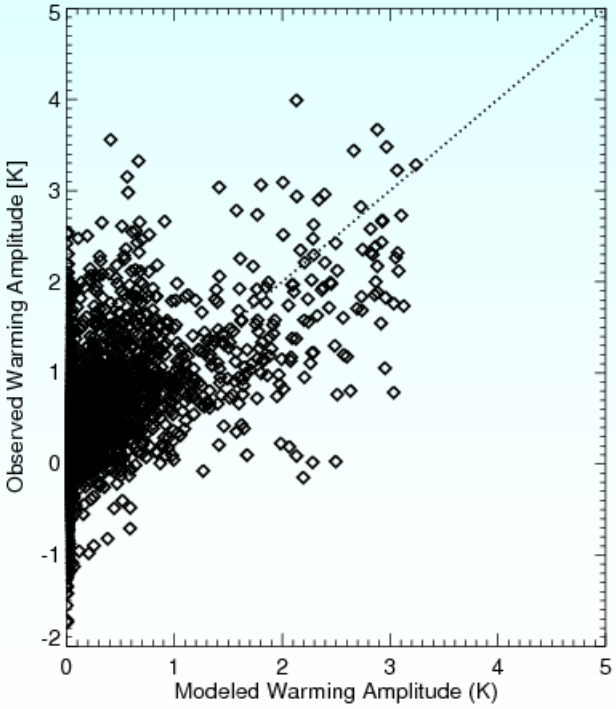
With Gustiness

June 21, 2014

0400 UTC



1400 UTC



2200 UTC

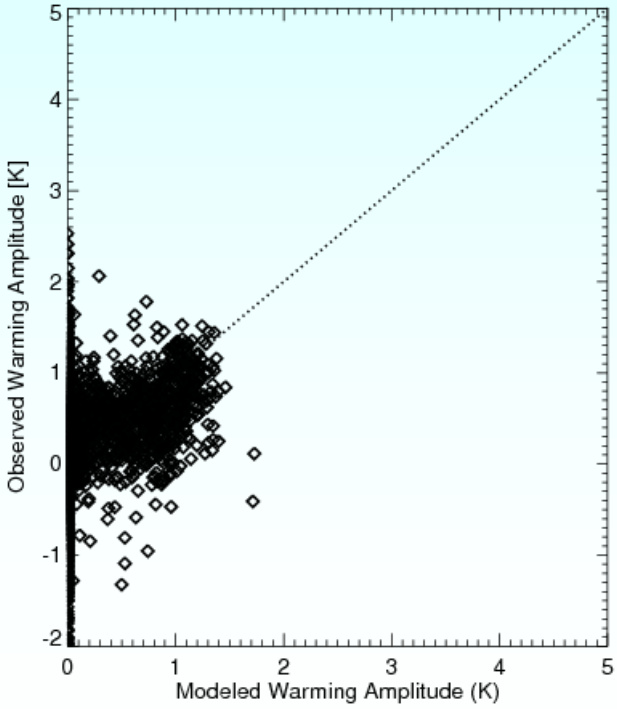


Illustration of Web Interface

http://www.esrl.noaa.gov/psd/psd2/coastal/satres/data/html/diurnal_sst_analysis.php