



# **High Resolution Daily Sea Surface Temperature Analysis: The Two Stage OI**

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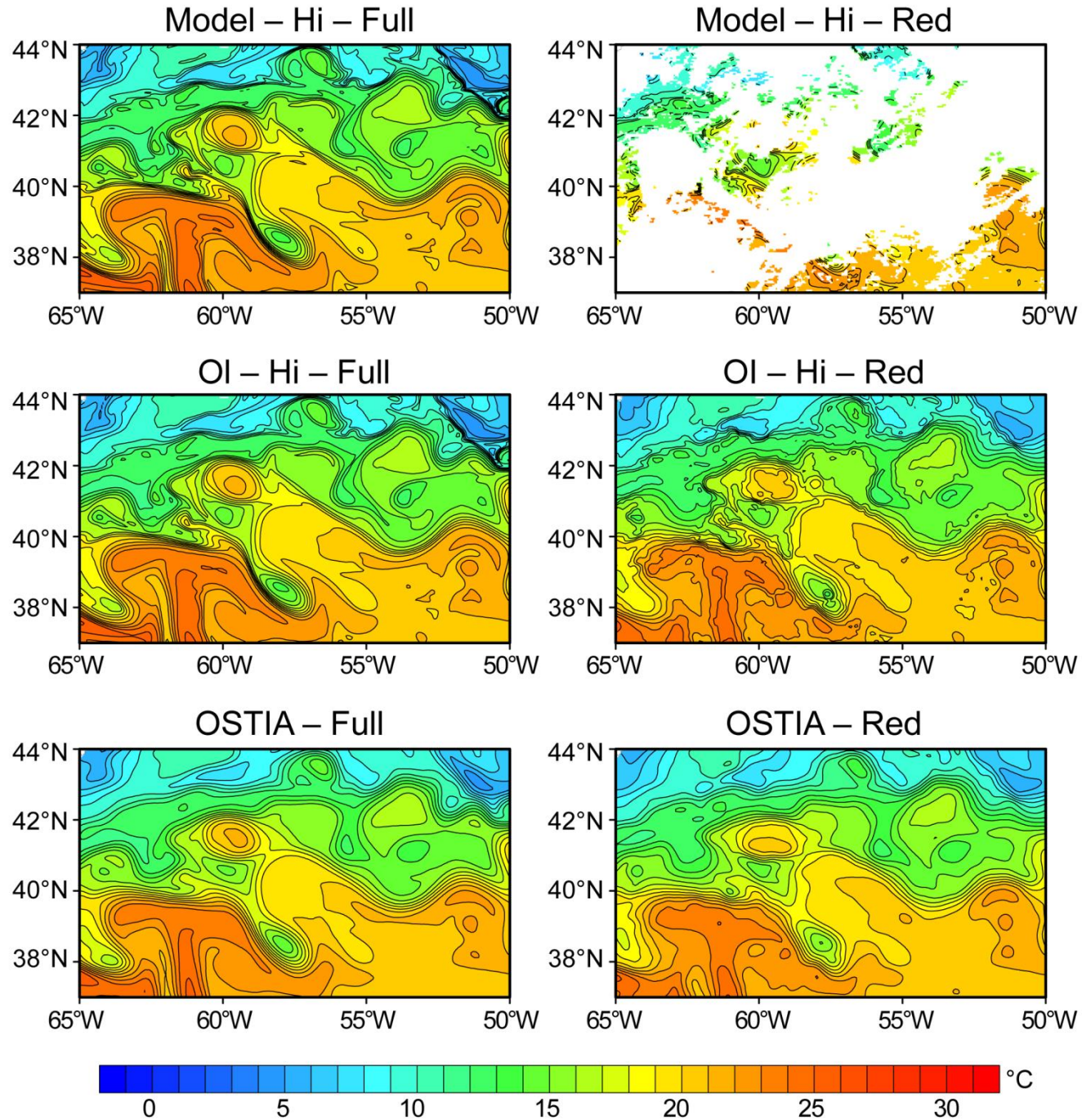
# Reynolds (et al., 2013)

et al = Chelton, Roberts-Jones, Martin, Menemenlis, Merchant

- Using “Synthetic SST Data” as “Truth” we evaluated the effects of sampling errors on 2 SST analyses
- Two Stage OI
  - High Resolution second stage produces High Resolution features, but as **data density** was **reduced** the **noise increased**
- OSTIA analysis
  - High Resolution features were smoothed and had lower **signal** and lower **noise** than OI High Resolution
- Good news: High Resolution features may be generated with and without data
- Bad news: High Resolution features with **little** or **no** data are **noise**

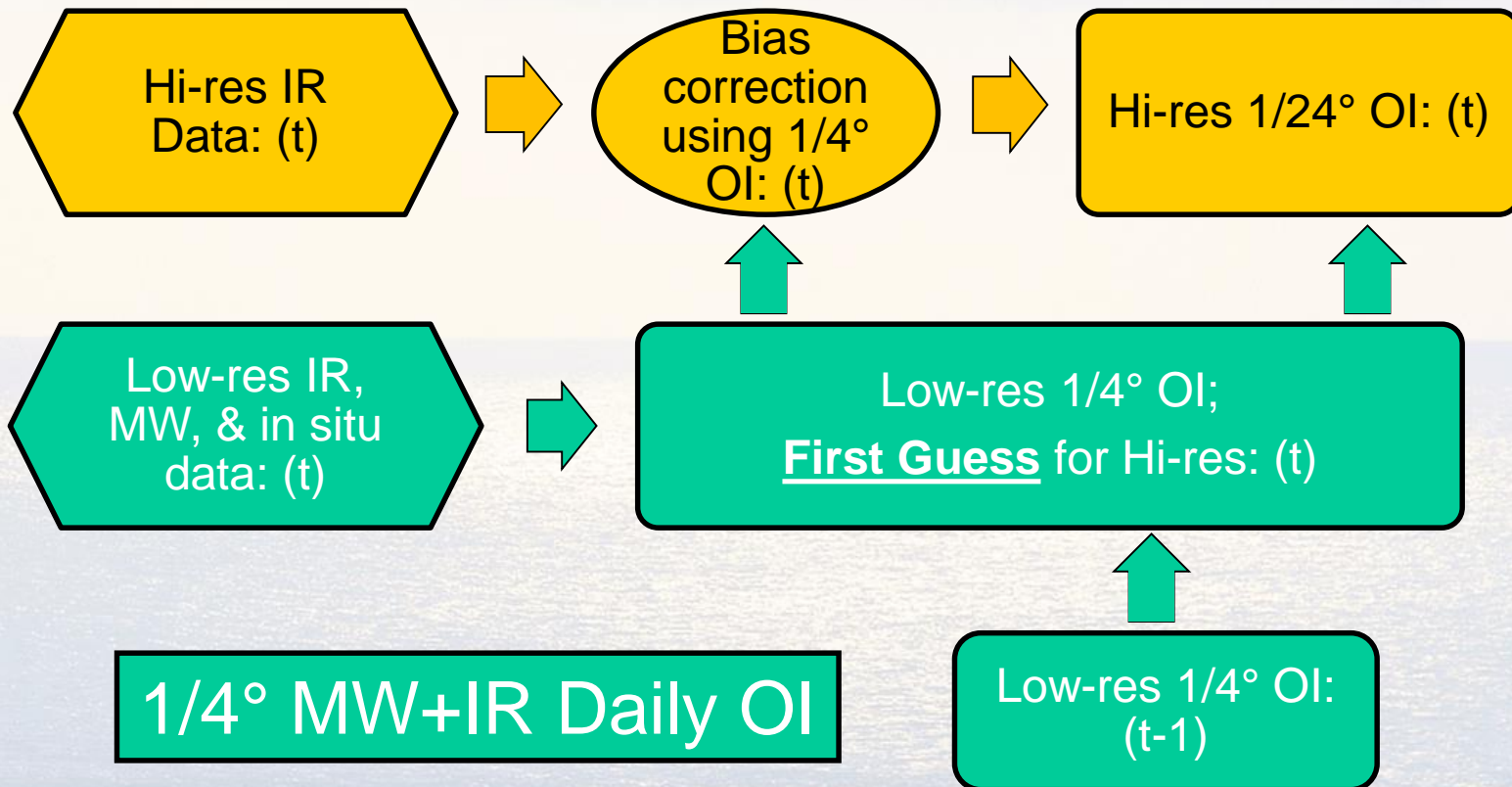
# SST Simulated Data & Analyses for 1 July 1993

- Left Panels: Full Data & Analyses
- Right Panels: Reduced Data & Analyses
- OSTIA Smoother than 2-Stage OI



# Two Stage OI

1/24° Hi-res Daily OI



# Advantages & Disadvantages of Two Stage OI

- **Advantages**

- MW and IR have very different spatial resolution, coverage and error characteristics
- Easy to design the two stages to reflect the differences
- High-resolution normalized error shows where high resolution data are used

- **Disadvantages**

- Interpolation from Low to High Resolution must be done carefully to avoid generating high-resolution noise
- For example, simple linear interpolation from low to high will have discontinuous slopes which add high-resolution noise

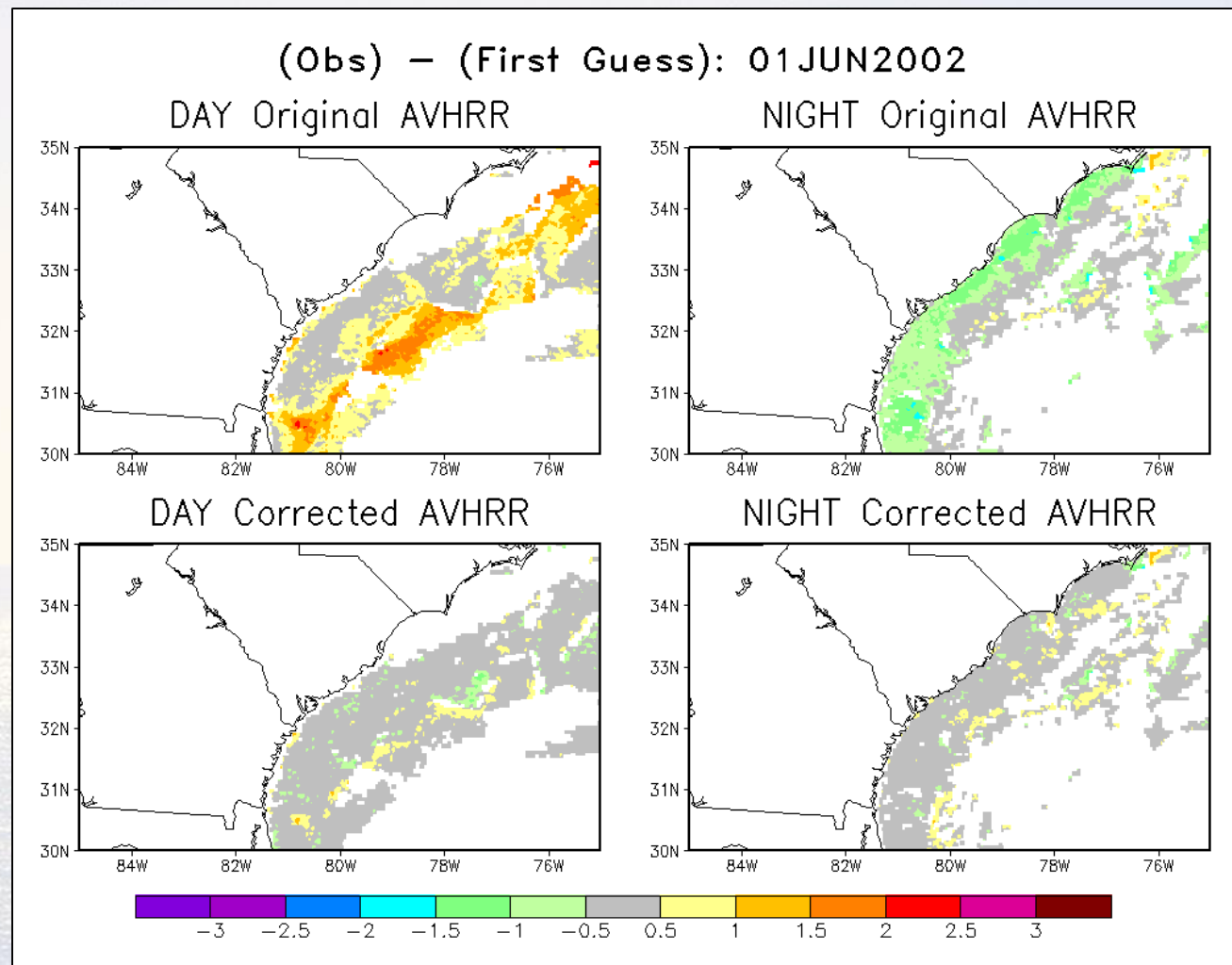
# Two Stage OI

- A research version of the high resolution second stage of the Two Stage OI is available for the AMSR period: 1 June 2002 – 4 October 2011
- The high resolution data are three days of AVHRR Pathfinder v5.2
- The high resolution OI is on the Pathfinder grid:  $1/24^\circ$
- The first guess for the low resolution bias correction and the high resolution analysis is the AMSR+AVHRR  $1/4^\circ$  OI (the first stage of the two stage OI)
- The AMSR+AVHRR  $1/4^\circ$  OI is assumed to be “truth” on scales of  $\sim 100$  km and larger

# (High resolution data) – (First guess)

1 June 2002

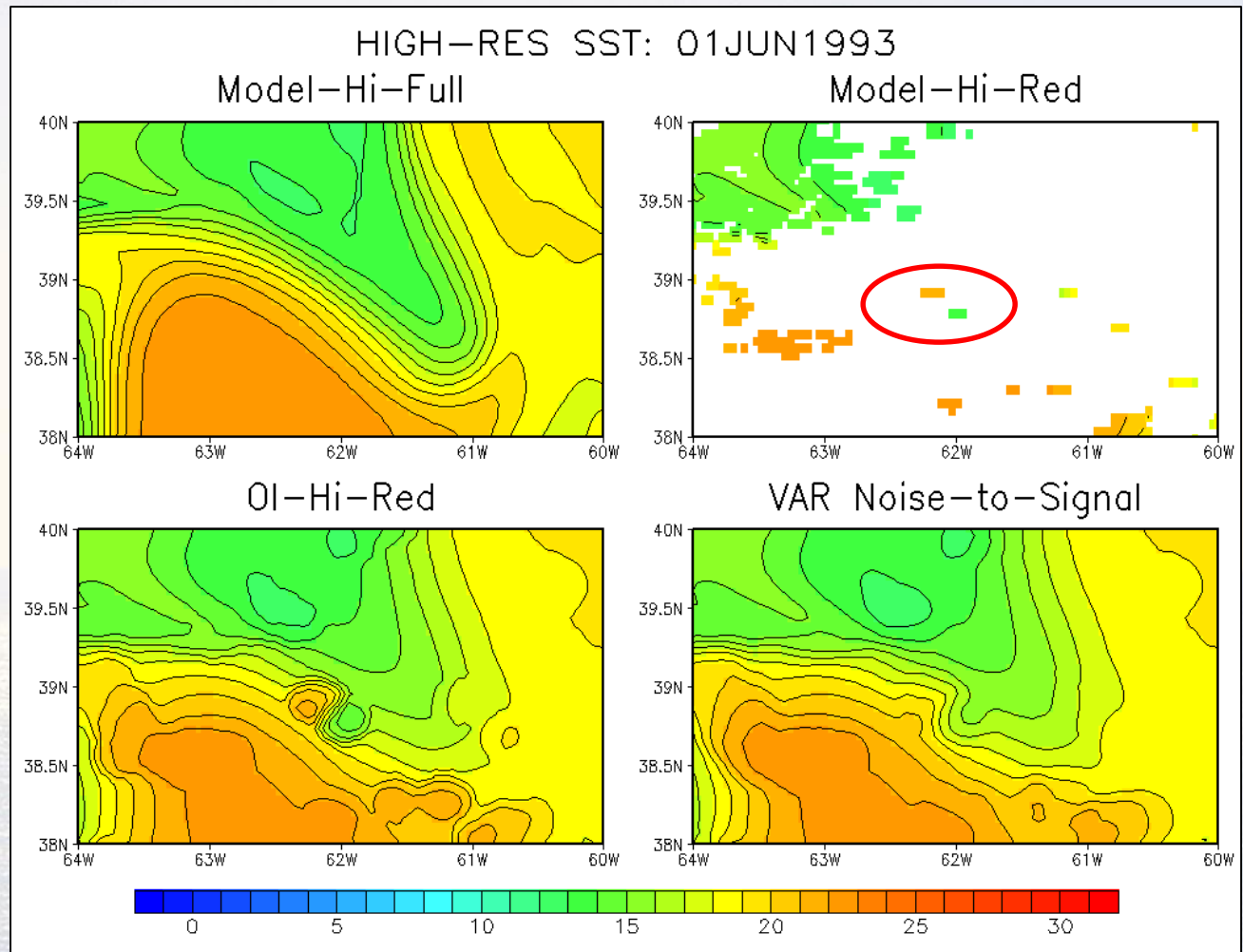
- Left panels:  
**Day**
- Right Panels:  
**Night**
- Top panels:  
**Uncorrected**
- Bottom Panels:  
**Corrected**
- Uncorrected data would result in large gradients in the high resolution OI



# SST Data & Analyses for 1 June 1993

## Variable Noise-to-Signal Ratio as a function of coverage

- **Note: circled noise dipole in Model Hi-Red**
- Dipole evident in analyzed OI-Hi-Red
- Analysis version with **variable noise-to-signal ratio (VNSR)** almost eliminates dipole
- $VNSR = (NSR) * R$   
 $R = (N_{max}/N)$   
 $R \geq 1$ 
  - $N_{max}$  is the maximum number of data points
  - $N$  is the actual number of data points

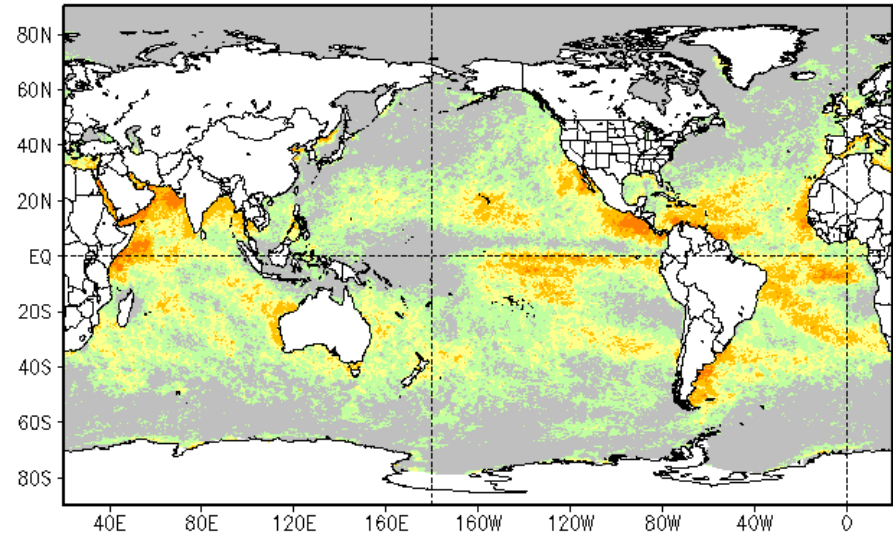




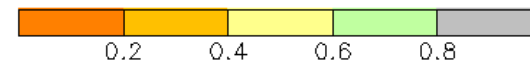
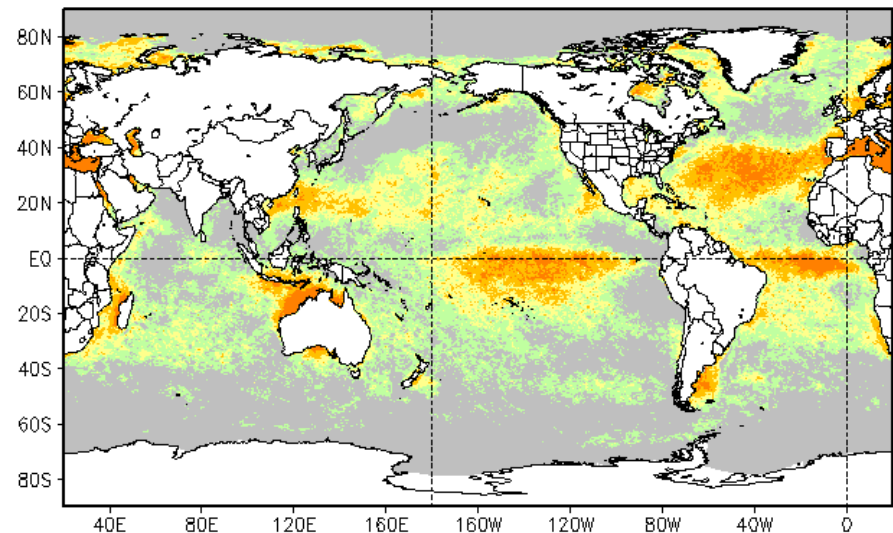
# Monthly Averaged Normalized Error for January and July 2003

- Normalized error ranges from 0 – 1
- No data is 1
- Increasing data reduces normalized error toward 0
- Colors clearly show where high resolution analyses are possible

January 2003

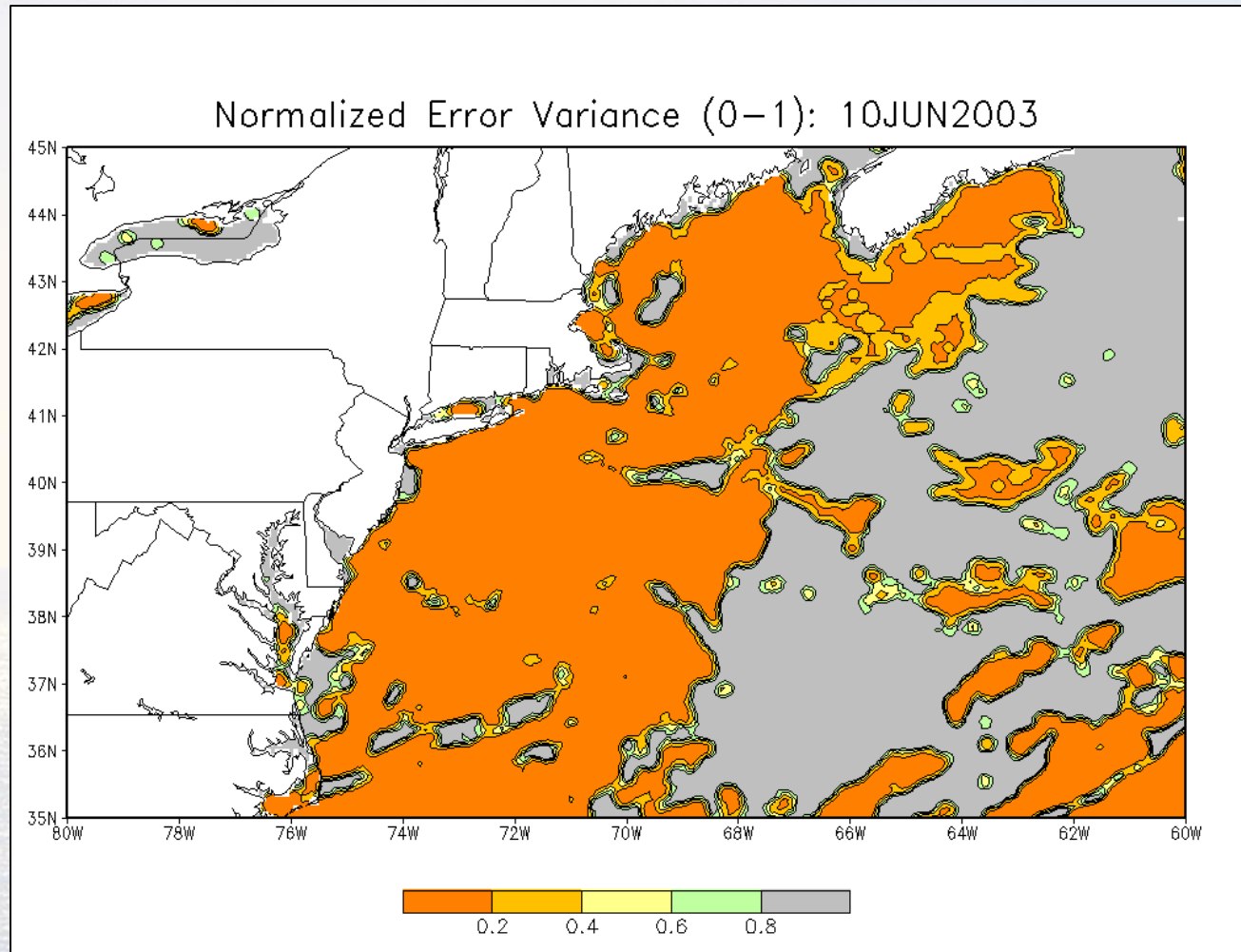


July 2003



# Normalized Error for 10 June 1993

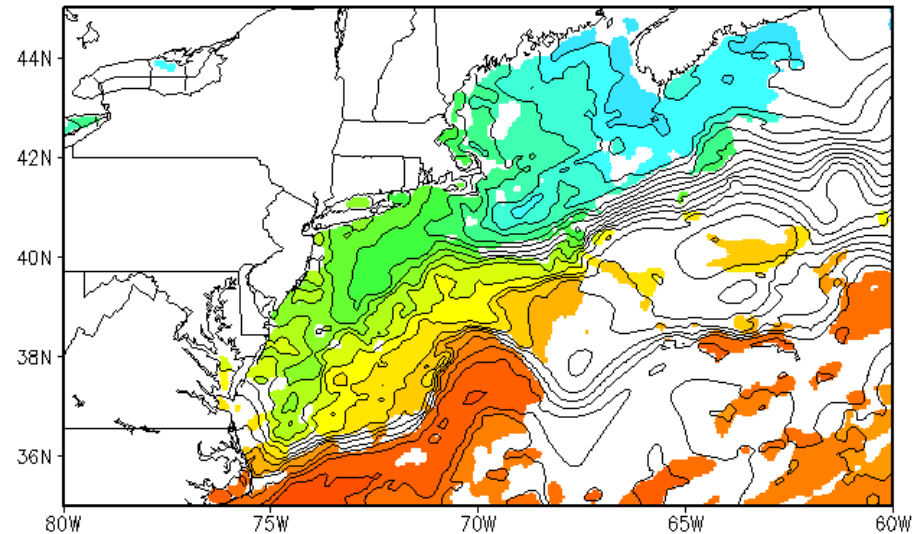
- Normalized error ranges from 0 – 1
- No data is 1
- Increasing data reduces error toward 0
- Pattern is almost binary showing in orange where high resolution data were available



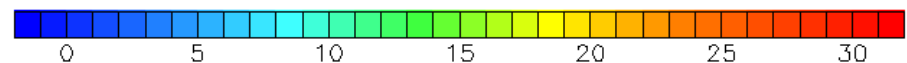
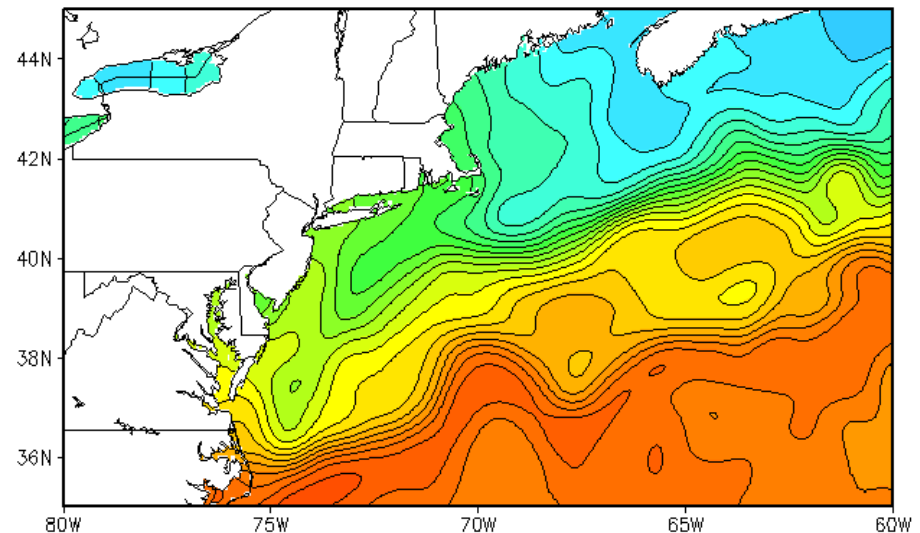
# SST Analyses on the High Resolution Grid: 10 June 2003

- Bottom Panel shows First Guess
- Top Panel shows high resolution analysis
- Color in the top panel uses the normalized error to show where high resolution data impacted the analysis

10JUN2003  
High Resolution SST



Low Resolution First Guess



# Summary

- The high resolution second stage of the Two Stage OI is available for the AMSR period: 1 June 2002 – 4 October 2011
- The high resolution OI is on the Pathfinder v5.2 grid:  $1/24^\circ$
- OI uses 3 days of Pathfinder data for each analysis
- The first guess is the AMSR+AVHRR  $1/4^\circ$  OI
- Output is netCDF including both the high resolution SST and the normalized error fields

# Future SST Work Plan: None/Retire



2013/5/27



