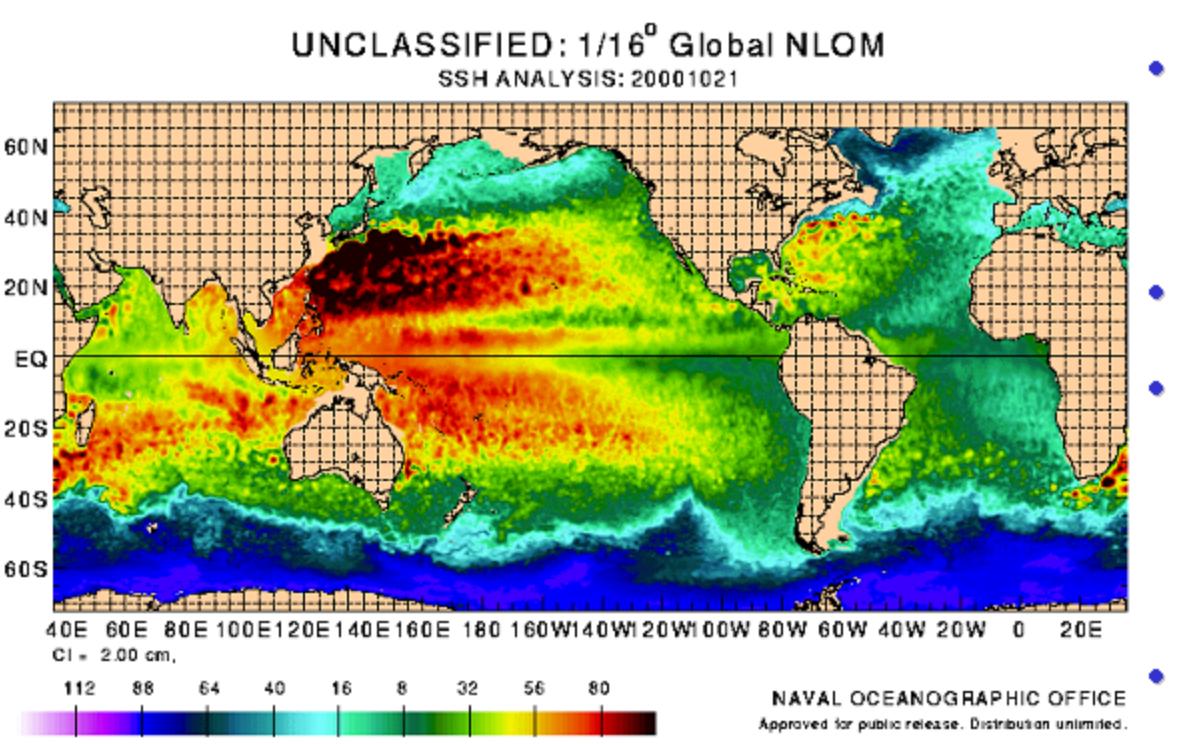


# A Real-Time 1/16° Global Ocean Nowcast/Forecast System

## ABSTRACT

An eddy-resolving global ocean nowcast/forecast system has been developed at the Naval Research Laboratory (NRL). The system uses a 7 layer Navy Layered Ocean Model (NLOM) with 1/16° resolution and is running in real time at the Naval Oceanographic Office (NOVO). The large size of the model (4096x2304x7) and operational requirements makes it necessary to use a computationally efficient assimilation scheme. Satellite altimeter data from Topex/Poseidon, ERS-2 and soon Geosat-Follow-on provided by NOVO's Altimeter Data Fusion Center (ADFC) are assimilated into the model. The method of assimilation is an incremental updating technique which includes: an OI deviation analysis, a statistical inference of lower layer corrections determined from the surface observations as well as a geostrophic correction to the velocities outside of the equatorial region. The sea surface temperature is relaxed to the daily Modular Ocean Data Assimilation System (MODAS) SST analysis. The results from the model are routinely used for ocean front and eddy analyses and prediction. The forecast skill of the model is being verified by comparing the forecast model to the analysis as soon as it becomes available. The results show that the model has predictive skill of the mesoscale variability for at least one month. Real-time results from the model can be viewed at the NRL web site [http://www7320.nrlssc.navy.mil/global\\_nlom](http://www7320.nrlssc.navy.mil/global_nlom)

## Navy Layered Ocean Model (NLOM)



- NRL global primitive equation ocean circulation model**
- 6 active layers**
- Forced by real-time NOGAPS surface heat fluxes and wind stresses**
- Assimilates satellite altimetry data and MODAS SST analysis**
- Provides SSH and Front & Eddy forecast capability**

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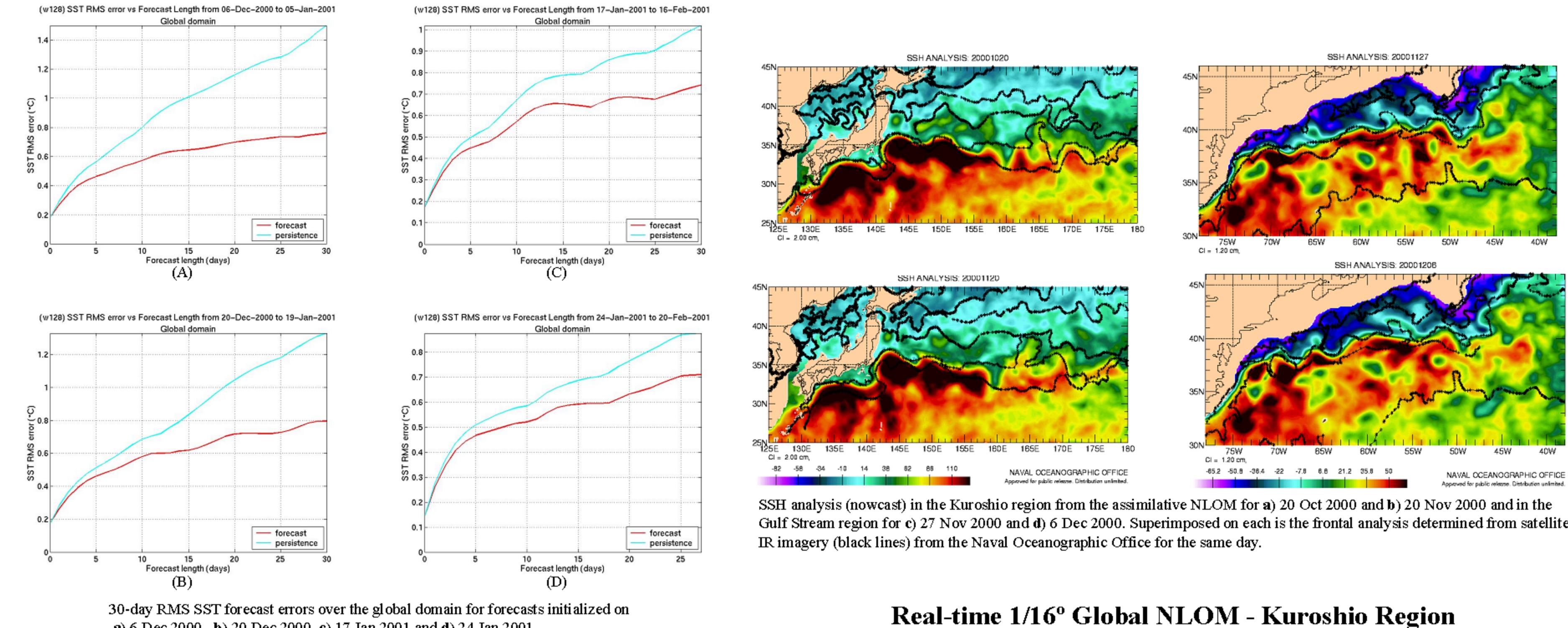
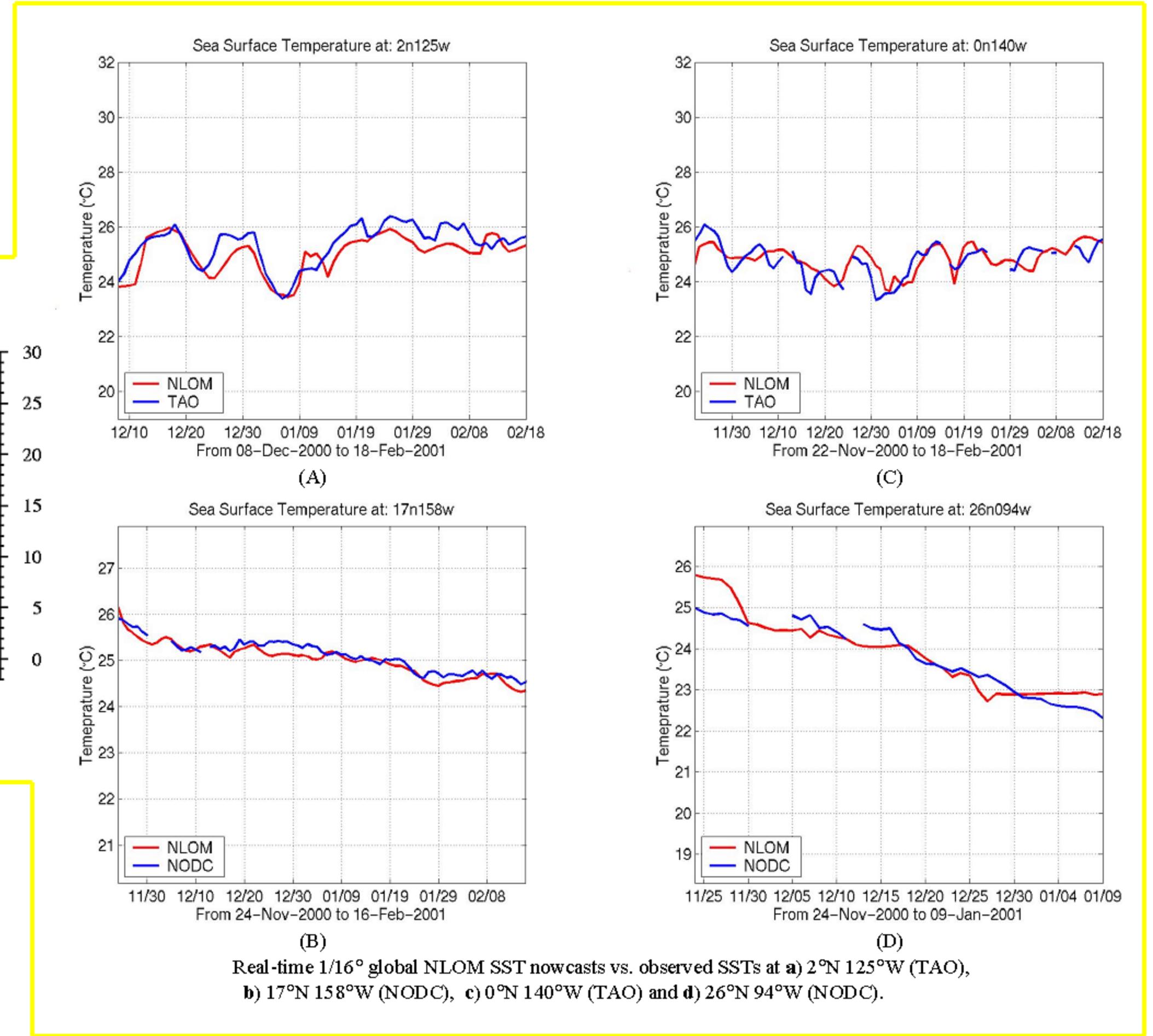
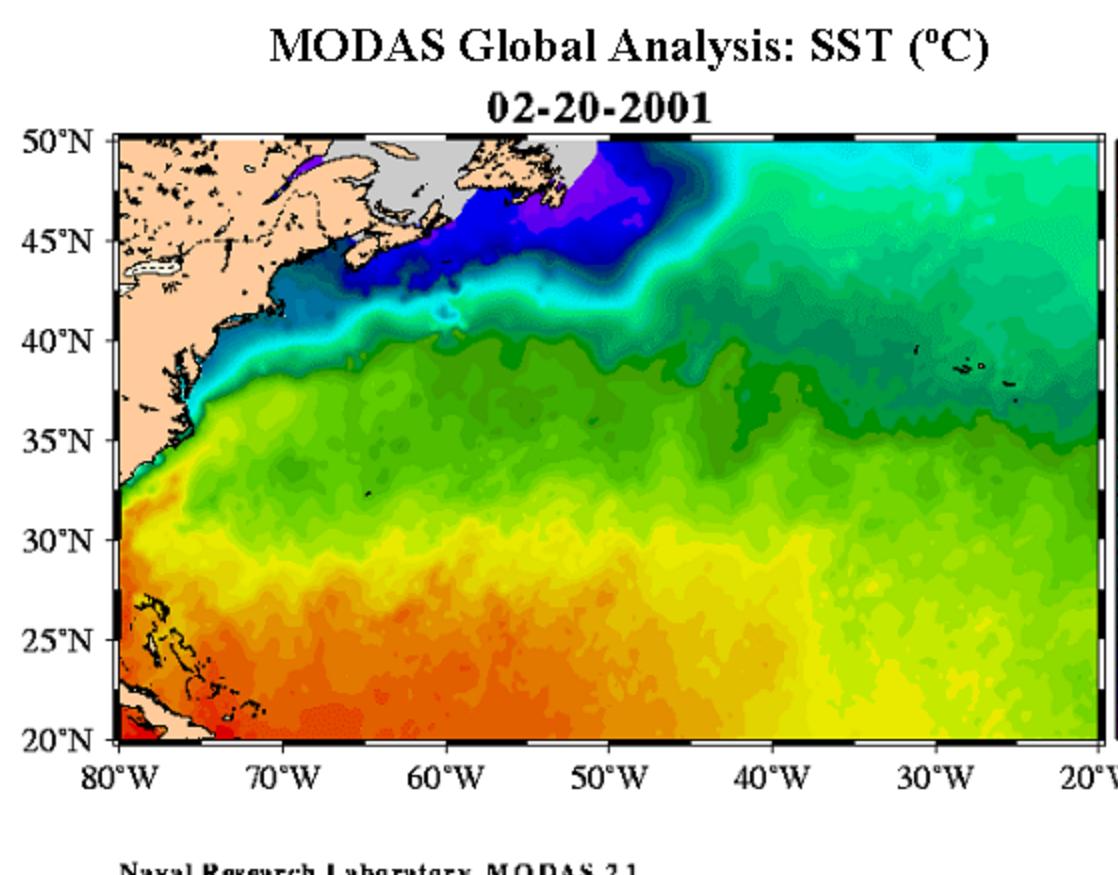
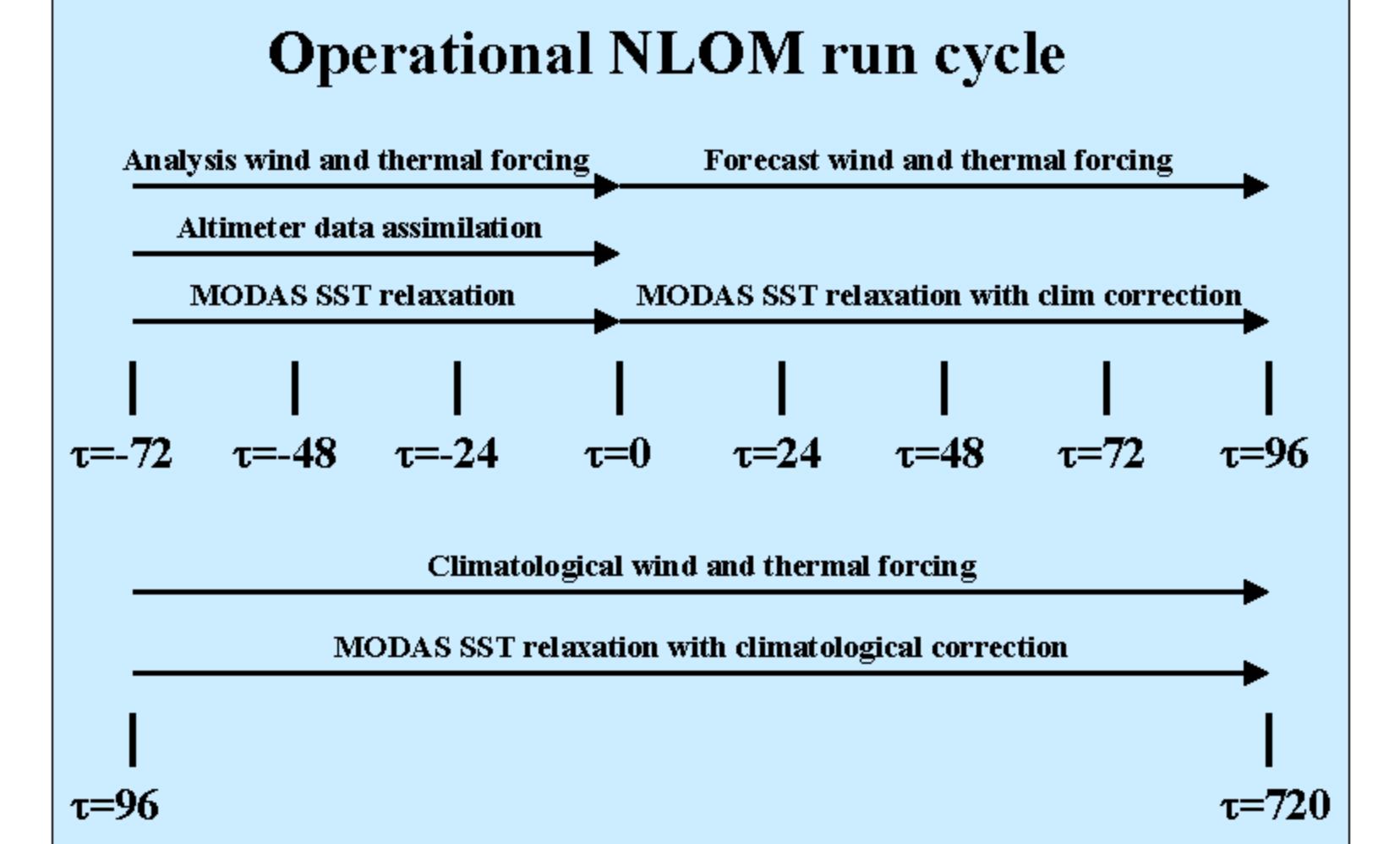
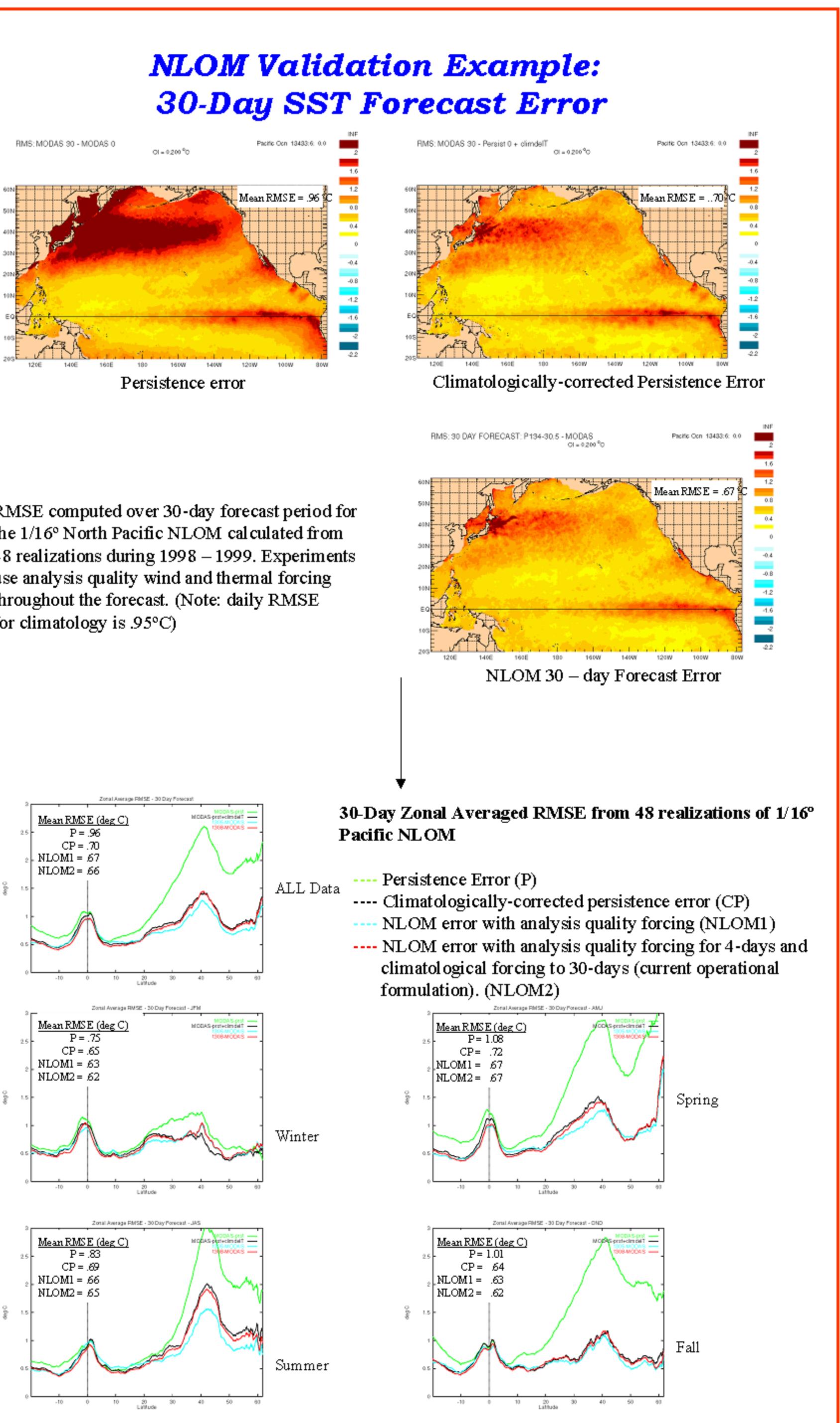
Sverdrup Technology

## Data Assimilation Methodology

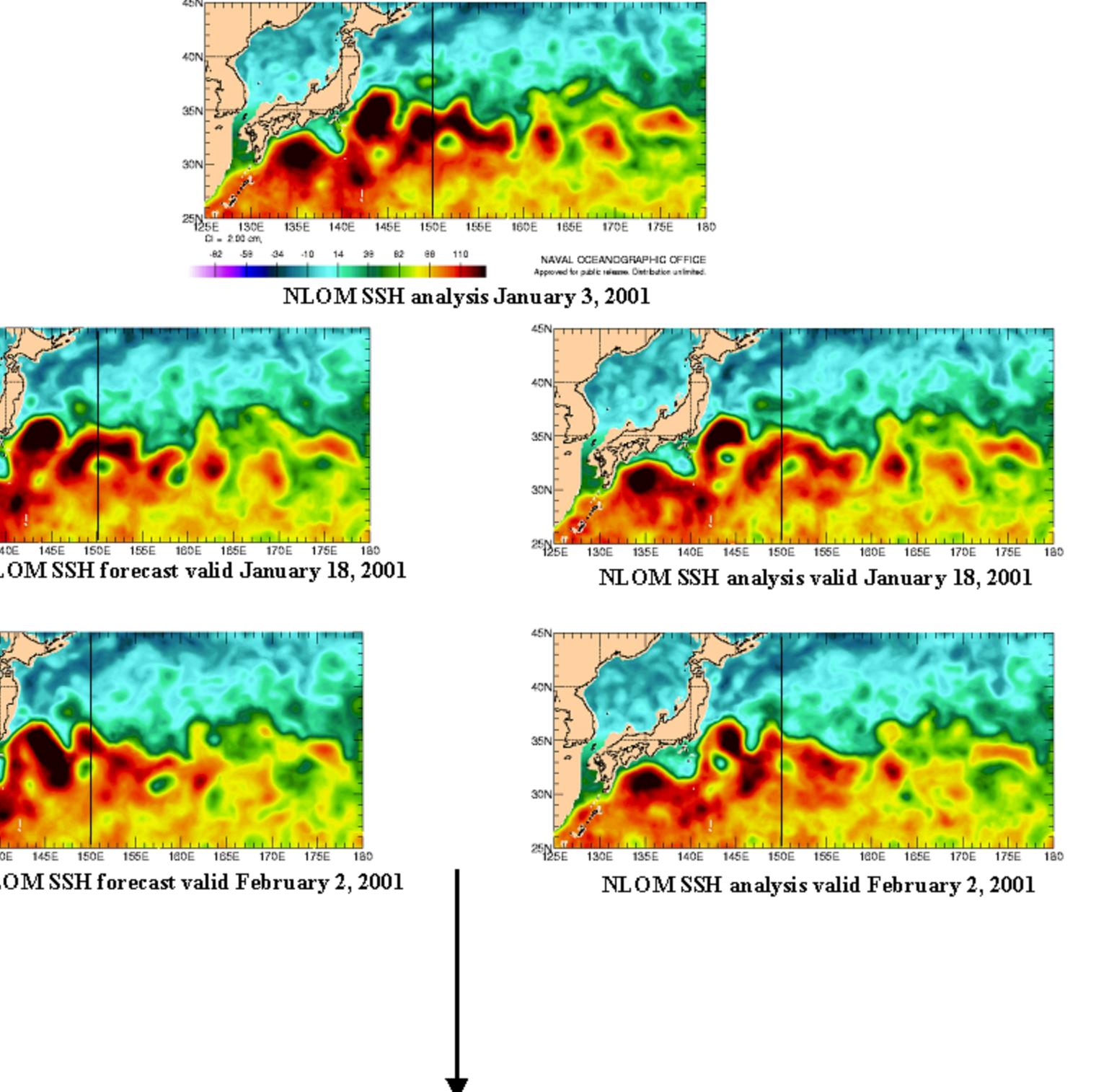
- OI deviation analysis using the model as first guess**
  - Mesoscale data covariance from T/P + ERS-2 data calculated by Jacobs et al.
  - 3-day window for altimetry
- Subsurface statistical inference via EOF regression**
  - Including the abyssal layer which has a major impact on the upper ocean circulation, Hurlburt et al. (1990, JGR-O)
- Velocity changes via geostrophy**
  - Outside of equatorial band
- Incremental updating to minimize gravity wave generation**
- Assimilation cycles need to go back approximately 3 days to pick up altimeter data with improved orbit removal**
  - More recent altimeter data with less accurate orbits are also used
- Relaxation to the daily MODAS SST analysis**

## Forcing used in operational NLOM

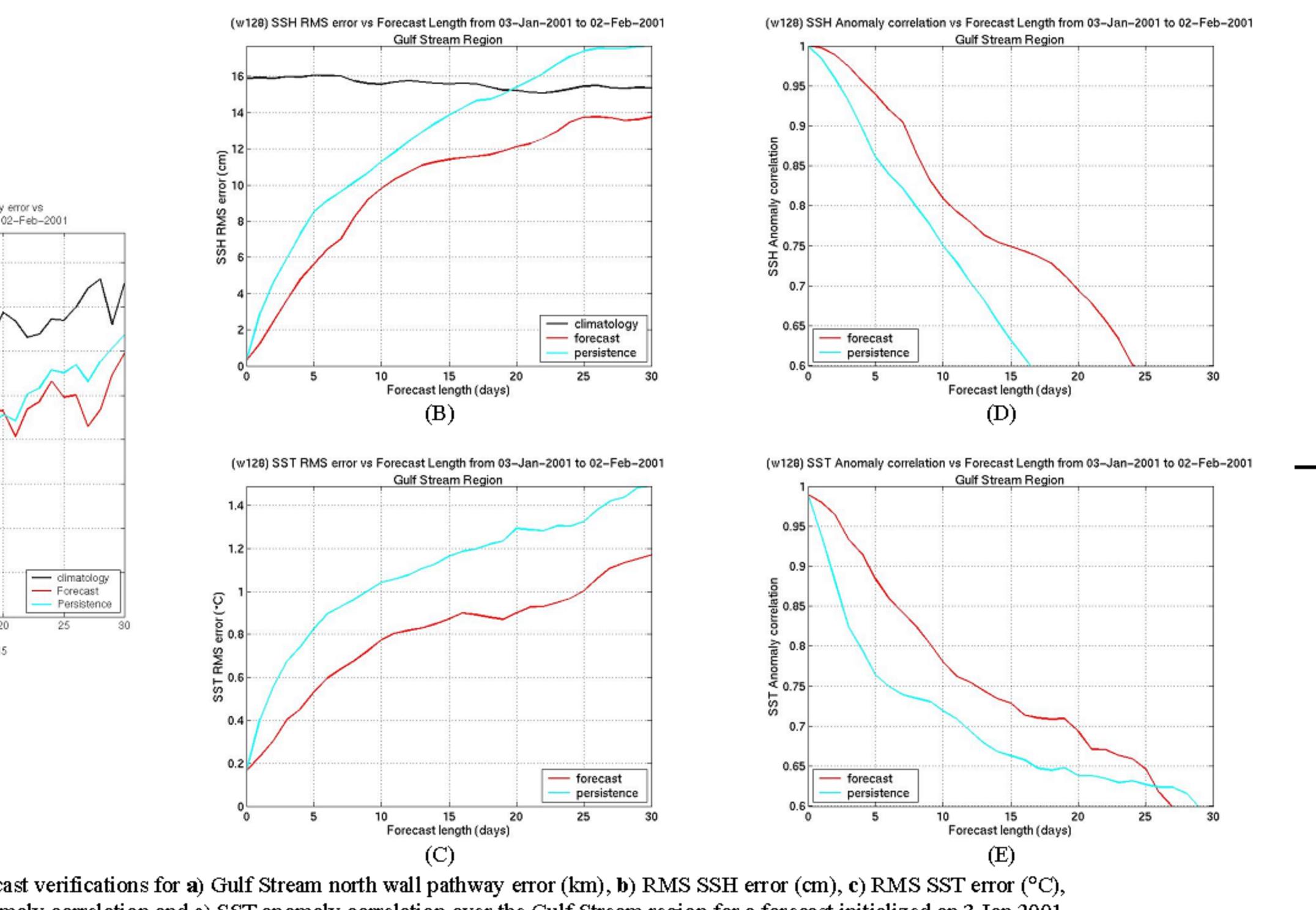
- Winds:** 1.0° FNMOC NOGAPS surface stresses
- Thermal:** 1.0° FNMOC NOGAPS heat fluxes
- SST:** 1/8° MODAS SST analyses
- In order to utilize the most accurate altimeter data, the system starts three days back in time and uses analysis wind and thermal forcing as it assimilates altimeter and SST data up to the nowcast time
- NOGAPS forecast wind and thermal forcing are used to produce a 4-day forecast, except on Wednesdays when a 30-day forecast is made
- Climatological wind and thermal forcing are used to extend the forecasts beyond 4 days
- In forecast mode, no altimeter assimilation is performed, but SST is relaxed back to the nowcast SST with a climatological correction applied



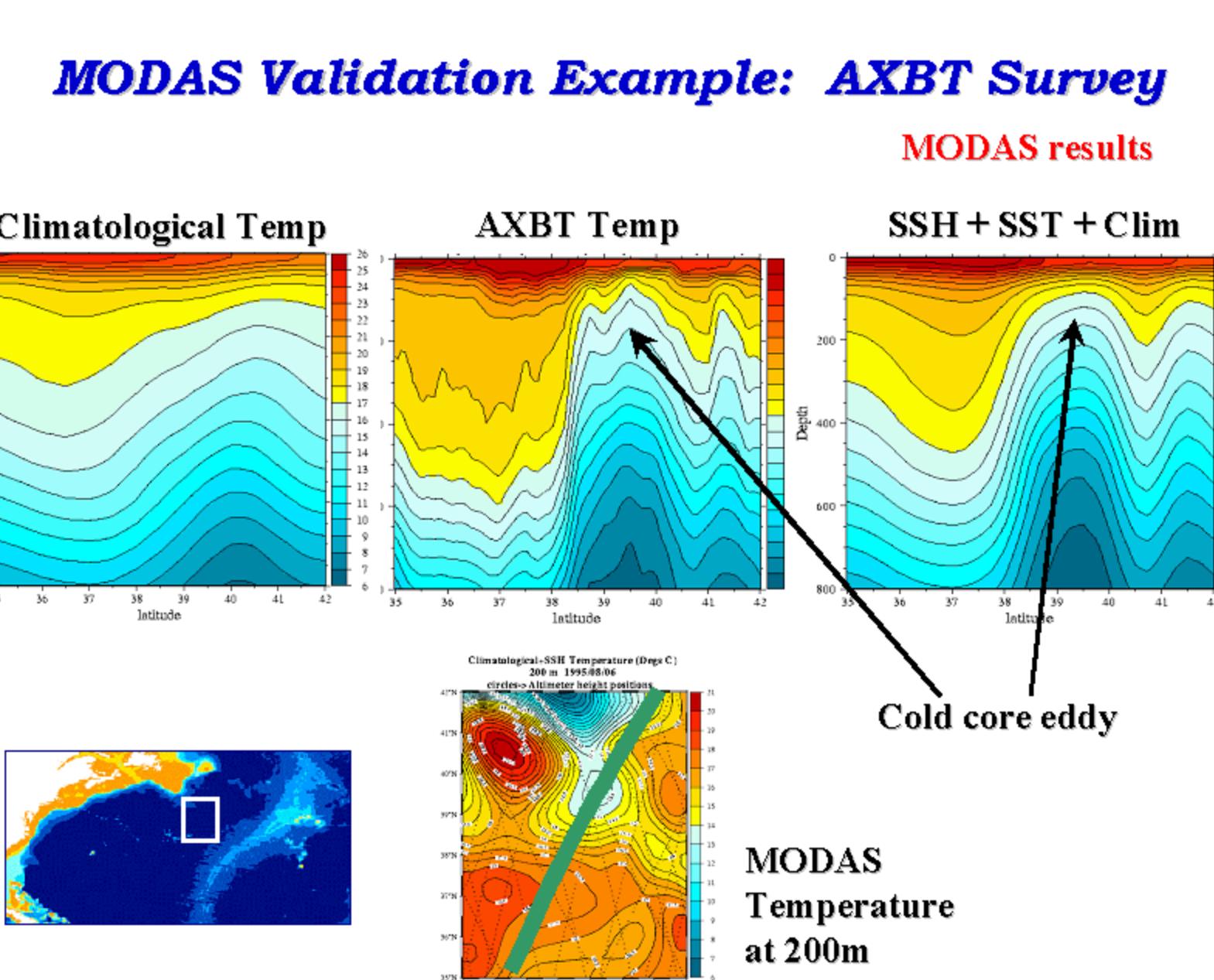
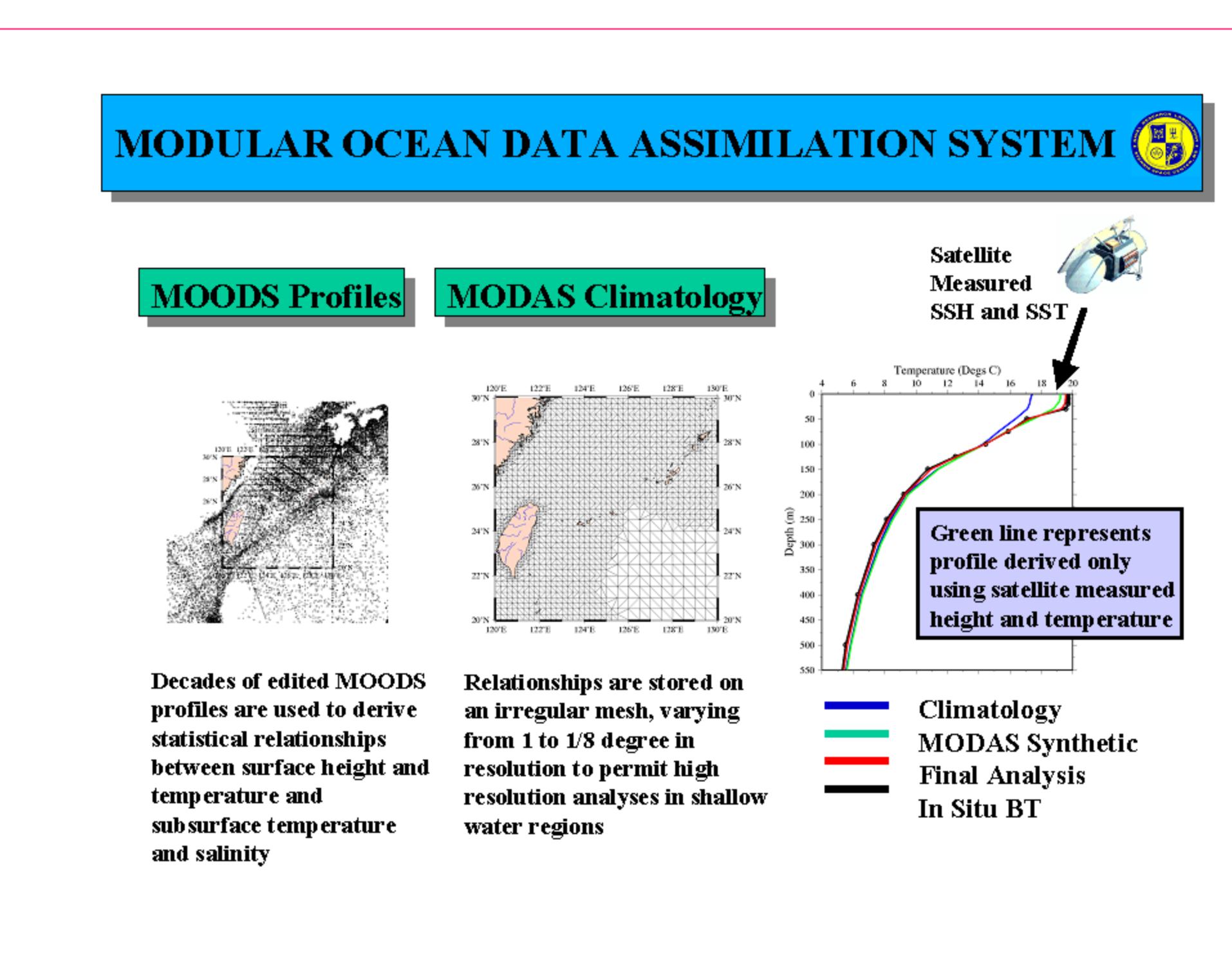
## Real-time 1/16° Global NLOM - Kuroshio Region



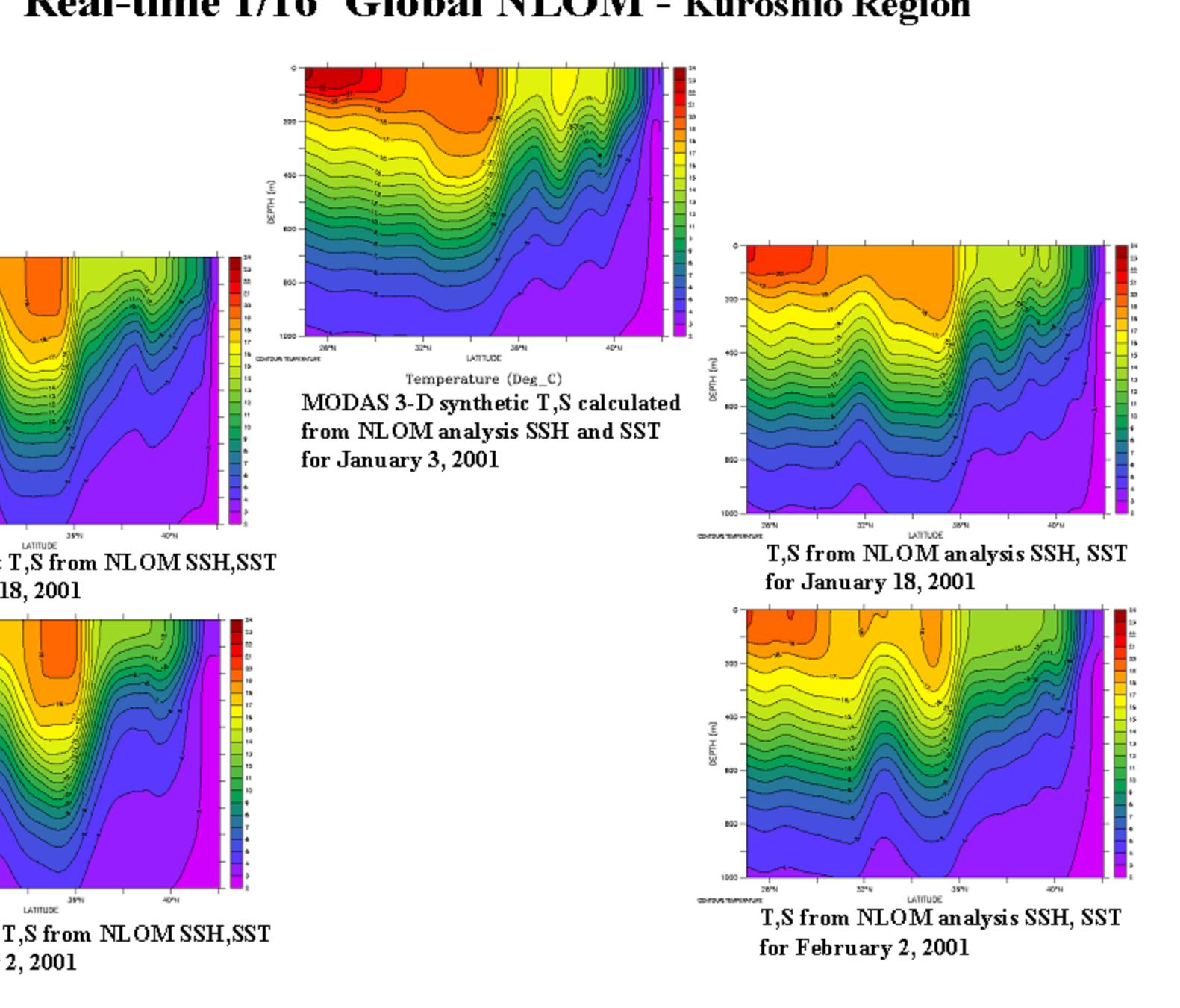
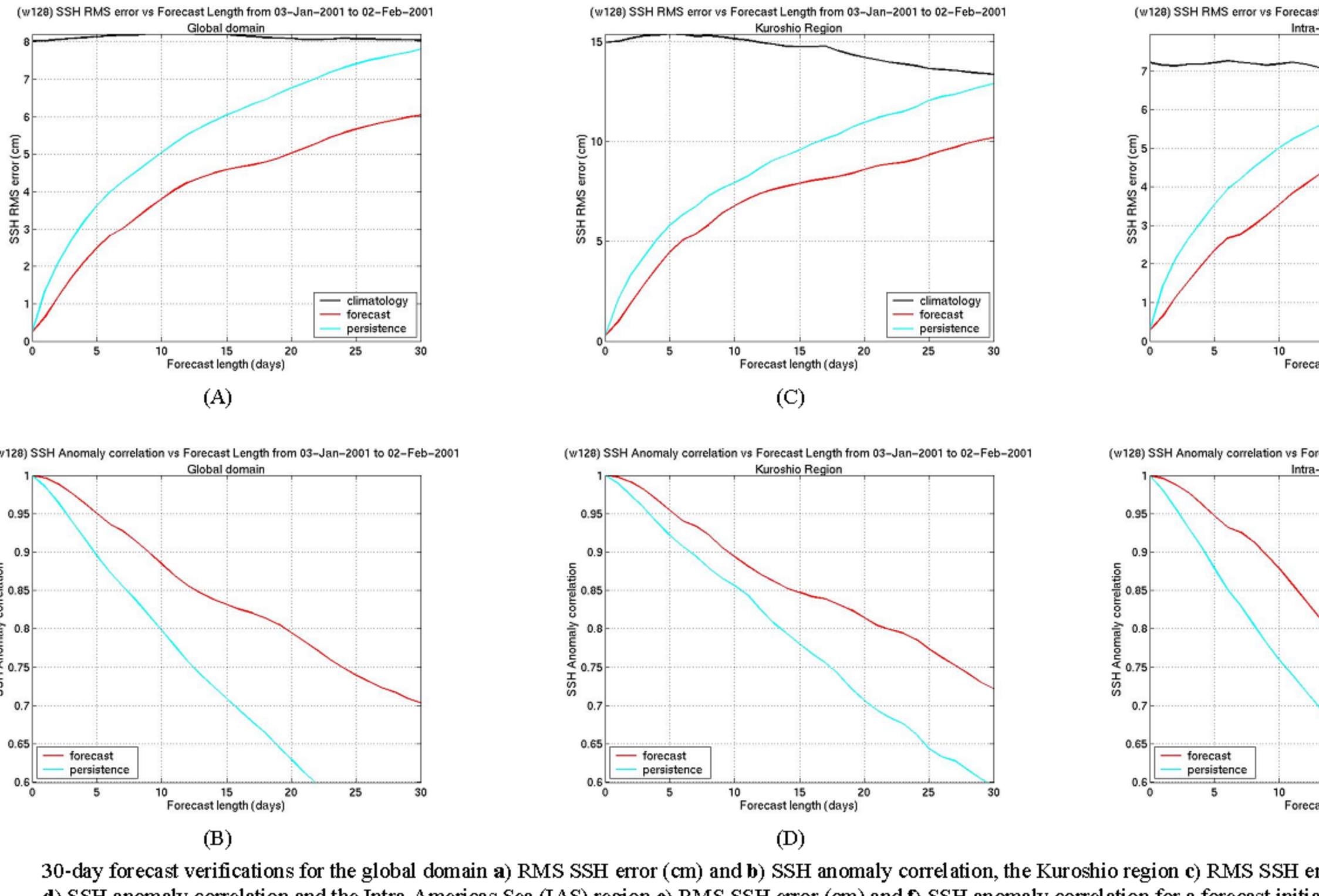
## 1/16° Global NLOM vs. 1/32° Global NLOM Gulf Stream Example – Climatological Forcing



Note: The Gulf Stream pathway is more accurately simulated at 1/32° resolution. An upgrade of this global system to 1/32° (planned for FY03) should improve forecast skill in this region.



<http://www7300.nrlssc.navy.mil/modas>



**Real-Time results (updated daily)**  
[http://www7320.nrlssc.navy.mil/global\\_nlom/index.html](http://www7320.nrlssc.navy.mil/global_nlom/index.html)