

Real-time Ocean Data Assimilation and Prediction with Global NCOM

Real-Time and archived results (updated daily): http://www.ocean.nrlssc.navy.mil/global_ncom

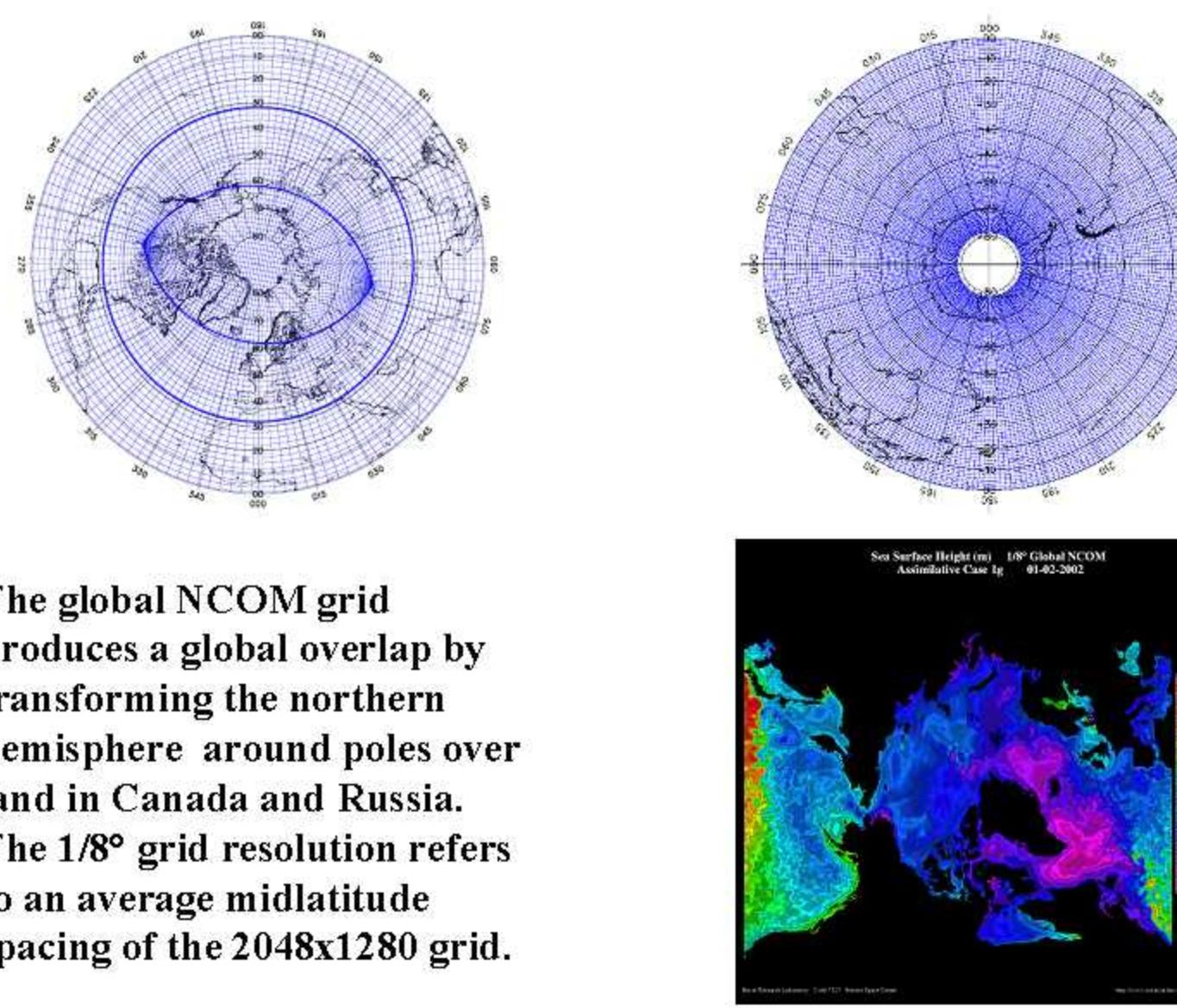
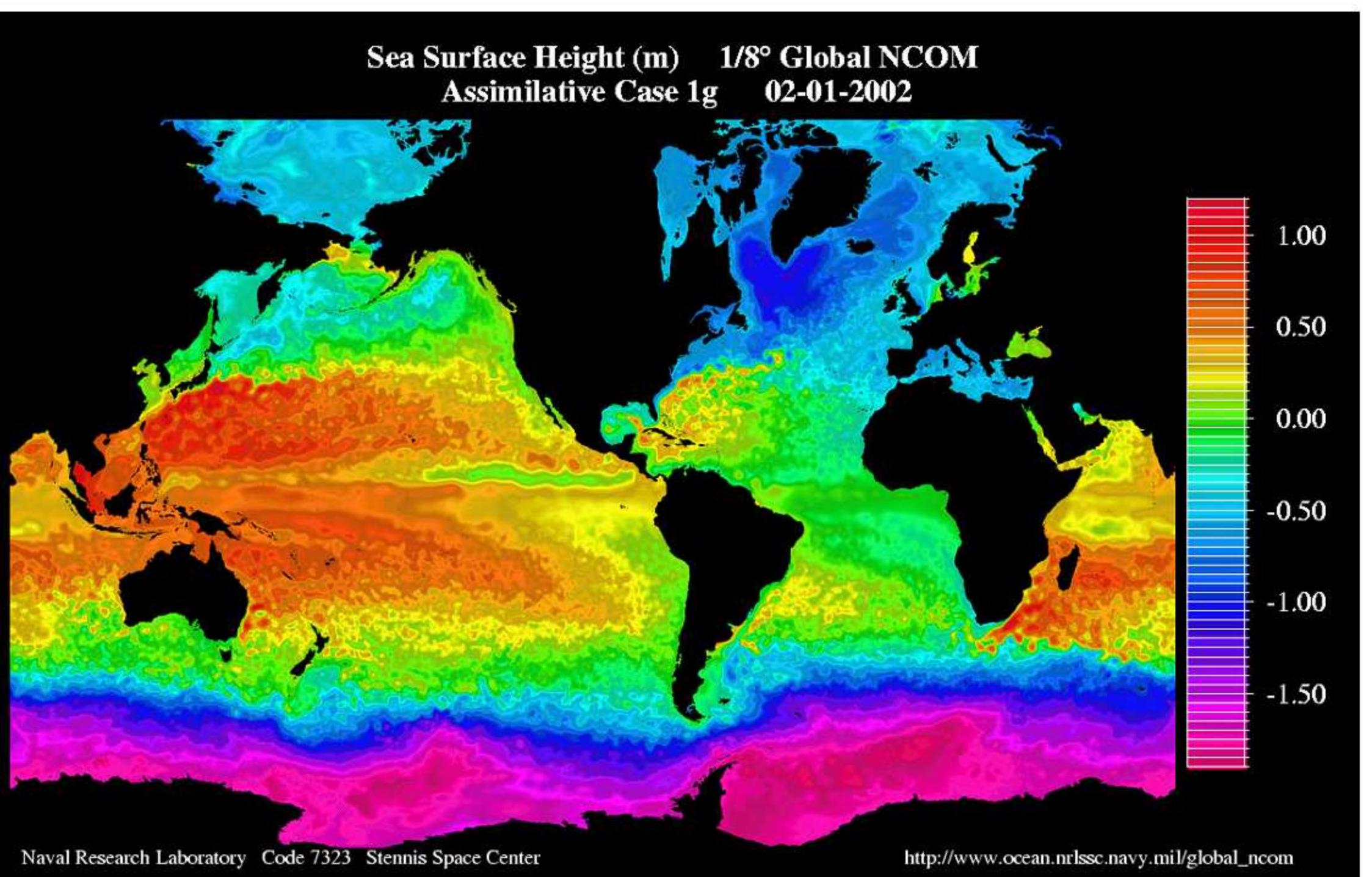
Abstract

A global implementation of the Navy Coastal Ocean Model (NCOM) has been developed by the Naval Research Laboratory (NRL) at Stennis Space Center. Global NCOM encompasses the open ocean to 5 m depth in a curvilinear global model grid with 1/8 degree grid spacing at 45°N, extending from 80°S to a complete arctic cap with grid singularities mapped into Canada and Russia. The model employs 40 vertical sigma-z levels, with sigma in the upper ocean and coastal regions, and z in the deeper ocean. The real-time system uses Navy Operational Global Atmospheric Prediction System (NOGAPS) 3-hourly wind stresses and heat fluxes. Operationally available sea surface temperature (SST) and altimetry (SSH) data are incorporated into NAVOCEANO Modular Ocean Data Assimilation System (MODAS) and Navy Layered Ocean Model (NLOM) analyses and forecasts of SSH and SST. These in turn are combined with the MODAS synthetic database to yield three-dimensional fields of temperature and salinity for assimilation into global NCOM. The model climate is evaluated by comparison with observed transport mean and variability, surface height variability, and large-scale thermal structure.

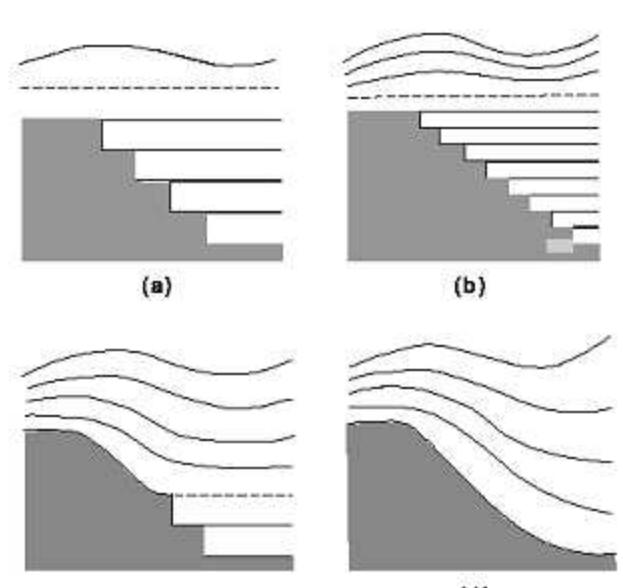
C. N. Barron, C. Rowley, R. C. Rhodes, L. F. Smedstad and J. M. Dastugue

Naval Research Laboratory

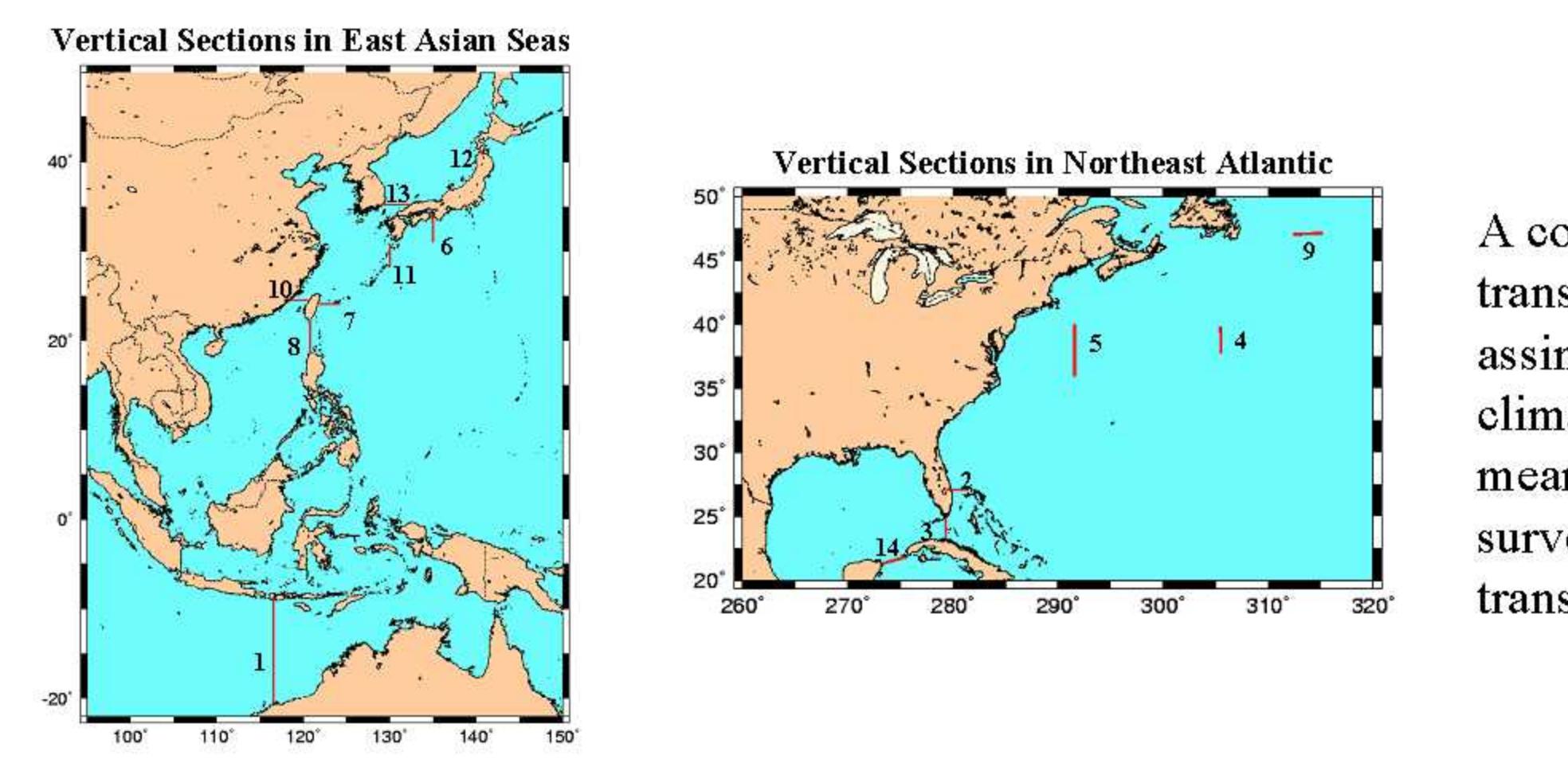
- 40 vertical sigma-z levels (19/21)
- 1m max upper layer thickness
- Fully global ocean with polar overlap and depth to 5m.
- Forced by real-time NOGAPS surface wind stress and heat fluxes
- Assimilates SST, SSS and 3D T&S from MODAS3D analysis of MODAS2D SST and MODAS2D or NLOM SSH
- Provides nesting with coastal ocean and relocatable models and improved coastal and upper ocean forecast capability



The global NCOM grid produces a global overlap by transforming the northern hemisphere around poles over land in Canada and Russia. The 1/8° grid resolution refers to an average midlatitude spacing of the 2048x1280 grid.



The figures at left indicate options for configuring the sigma-z vertical coordinate in NCOM:
(a) levels with free surface
(b) sigma levels over z levels
(c) more sigma over z levels
(d) sigma levels only

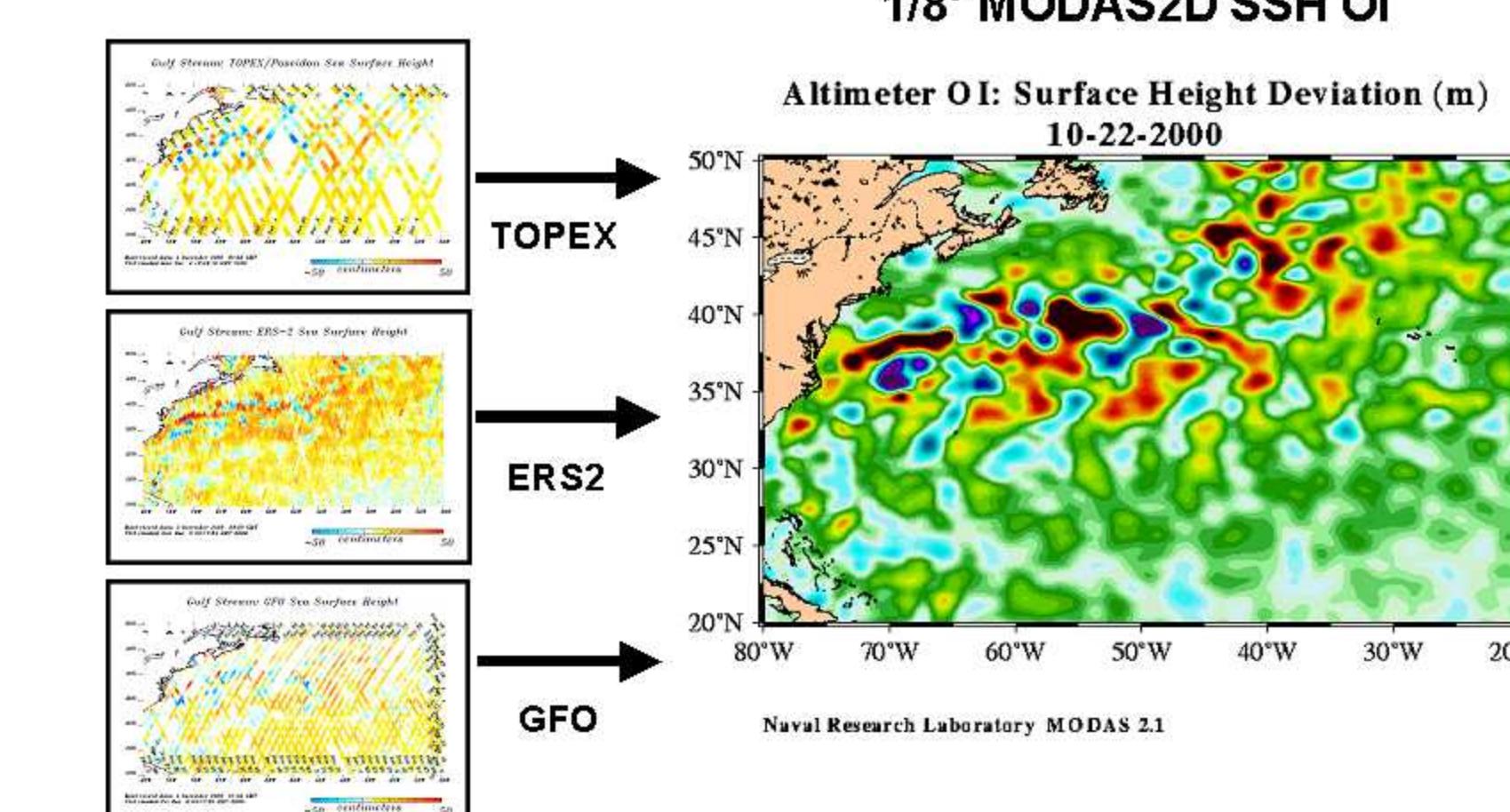
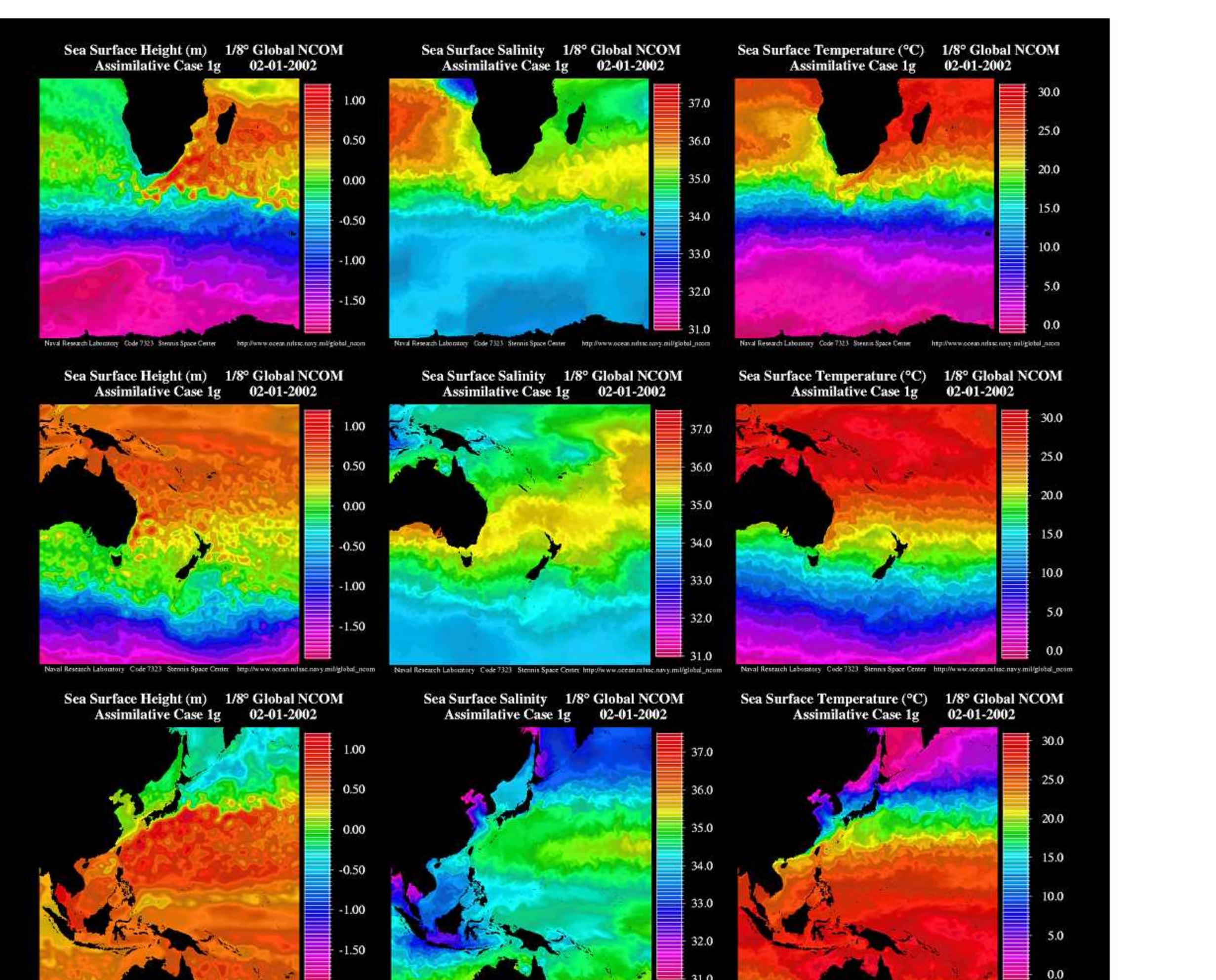
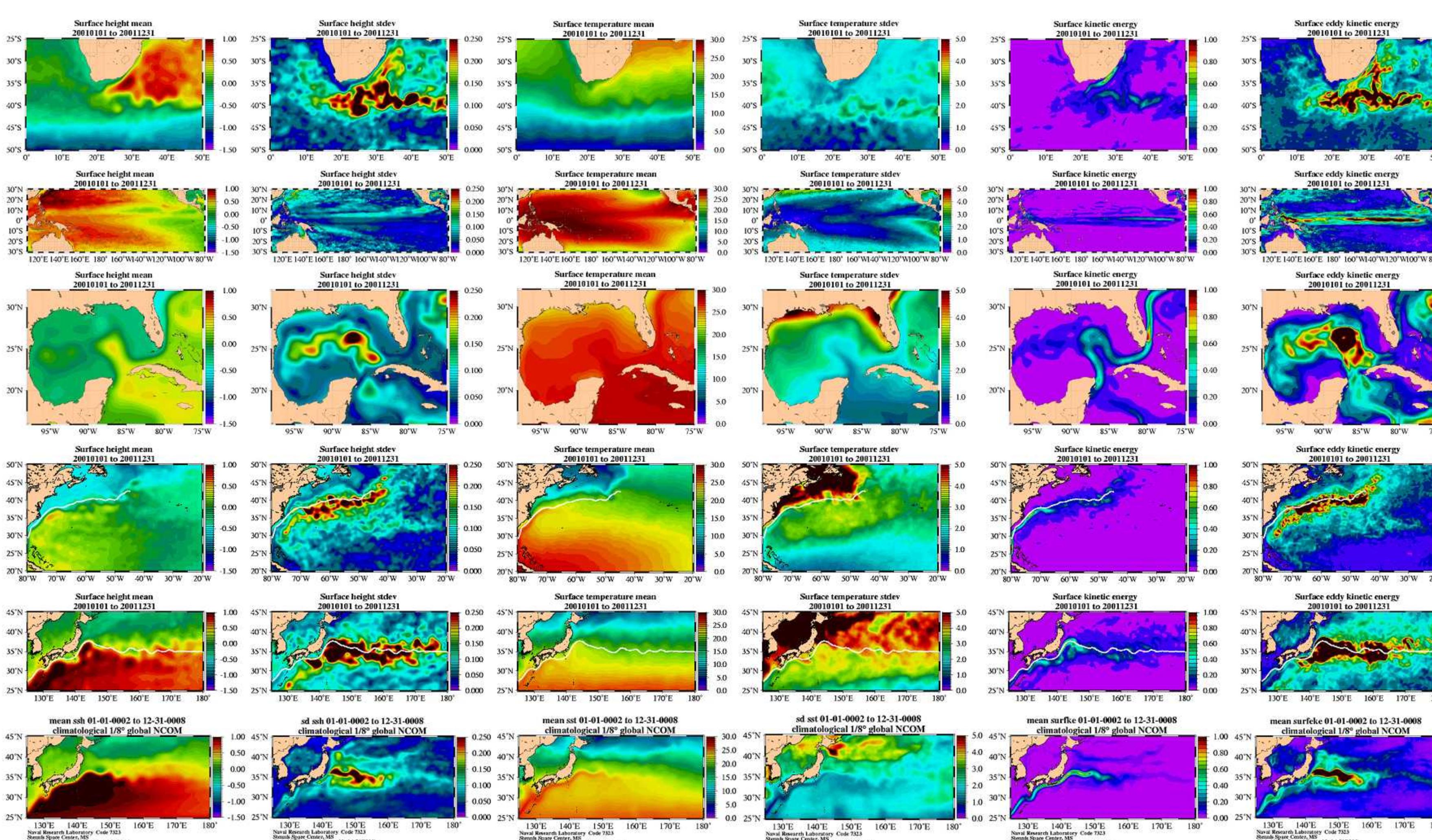


A comparison of selected volume transport measurements from the assimilative run glb8_1g (one-year mean), climatological run glb8_1i (four-year mean), and historical observations (single surveys or various means). Positive transports indicate northward or eastward.

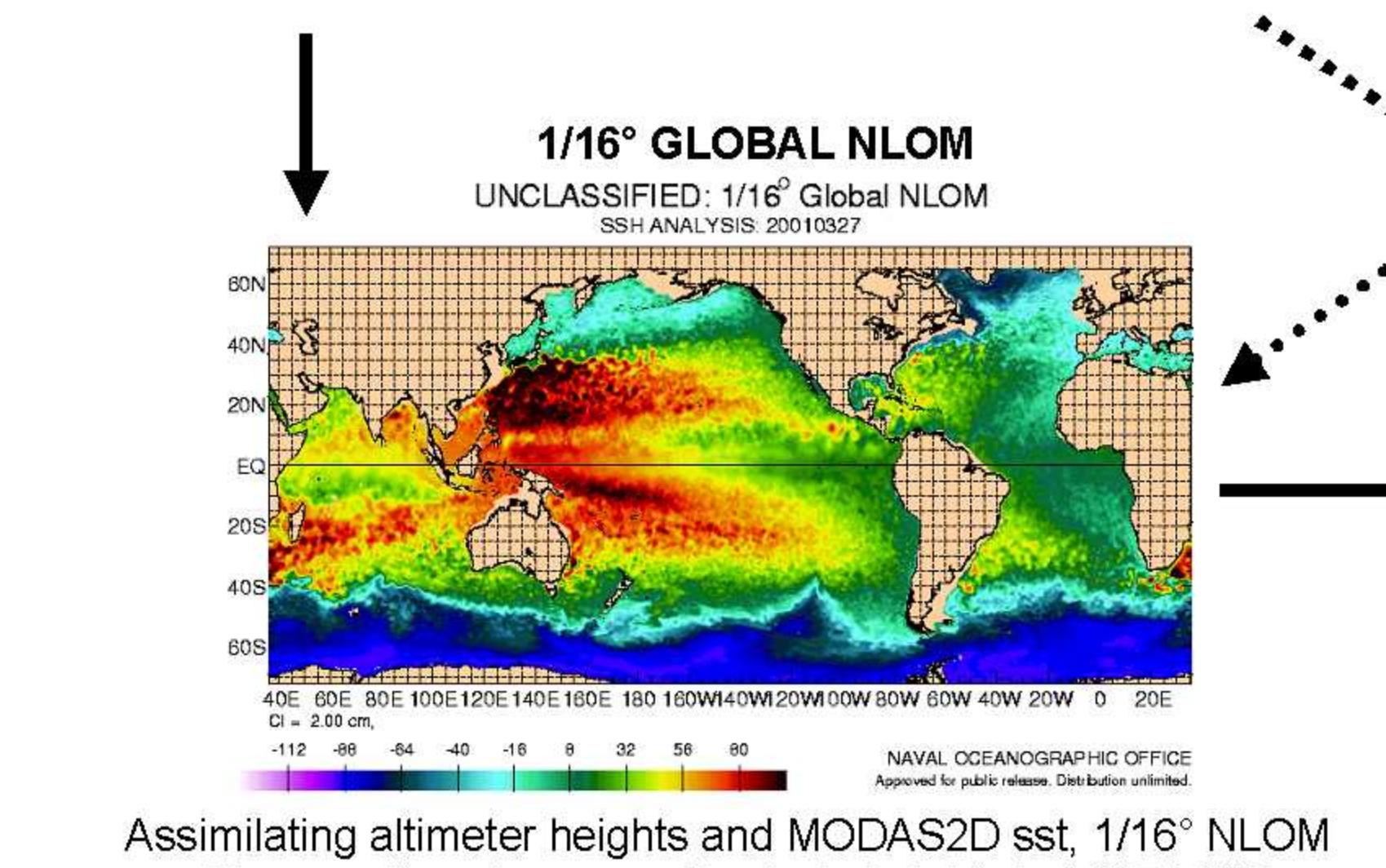
Legend	Location	Assimilative case (glb8_1g) for year 2001	Climatological Case (glb8_1i) for years 2.5	Reference	Source
1.	Azores	1.84	1.5	-16.2 (-16.8 + 2.6)	Schmitz, 1996b
2.	Florida, St. 27N	25.40	2.16	19.96	29, 32+3
3.	Florida, St. 91W	23.32	2.15	19.84	1.73
4.	Gulf Stream, 55W	164.12	122.66	12.95	Hall and Fofonoff, 1993
5.	Gulf Stream, 68W	61.61	39.02	28.42	Hall and Fofonoff, 1993
6.	Kuroshio, 135E	88.21	22.23	51.92	Imawaki et al., 1997
7.	Kuroshio, 24N	27.8	4.21	26.14	Schmitz, 1996b
8.	Luzon, Strait	-6.44	2.76	-6.81	Chu and Li, 2000
9.	St. Johns FL Cap	3.02	1.58	-6.32	Hill et al., 1975
10.	Taiwan, Strait	2.14	0.99	0.91	Teague et al., 2002; Feng et al., 1991
11.	Torres, Strait	20.23	3.97	3.92	Chu et al., 2001 in press
12.	Tasman, Strait	1.87	0.14	1.73	Chu et al., 2001 in press
13.	Tasman, Strait	2.71	0.51	2.38	Teague et al., 2002; Chu et al., 2001 in press
14.	Yucatan, Channel	23.26	2.14	19.84	Biggs et al., 1998; Candela et al., 2001

Statistics from the 1/8° assimilative global NCOM experiment glb8_1g

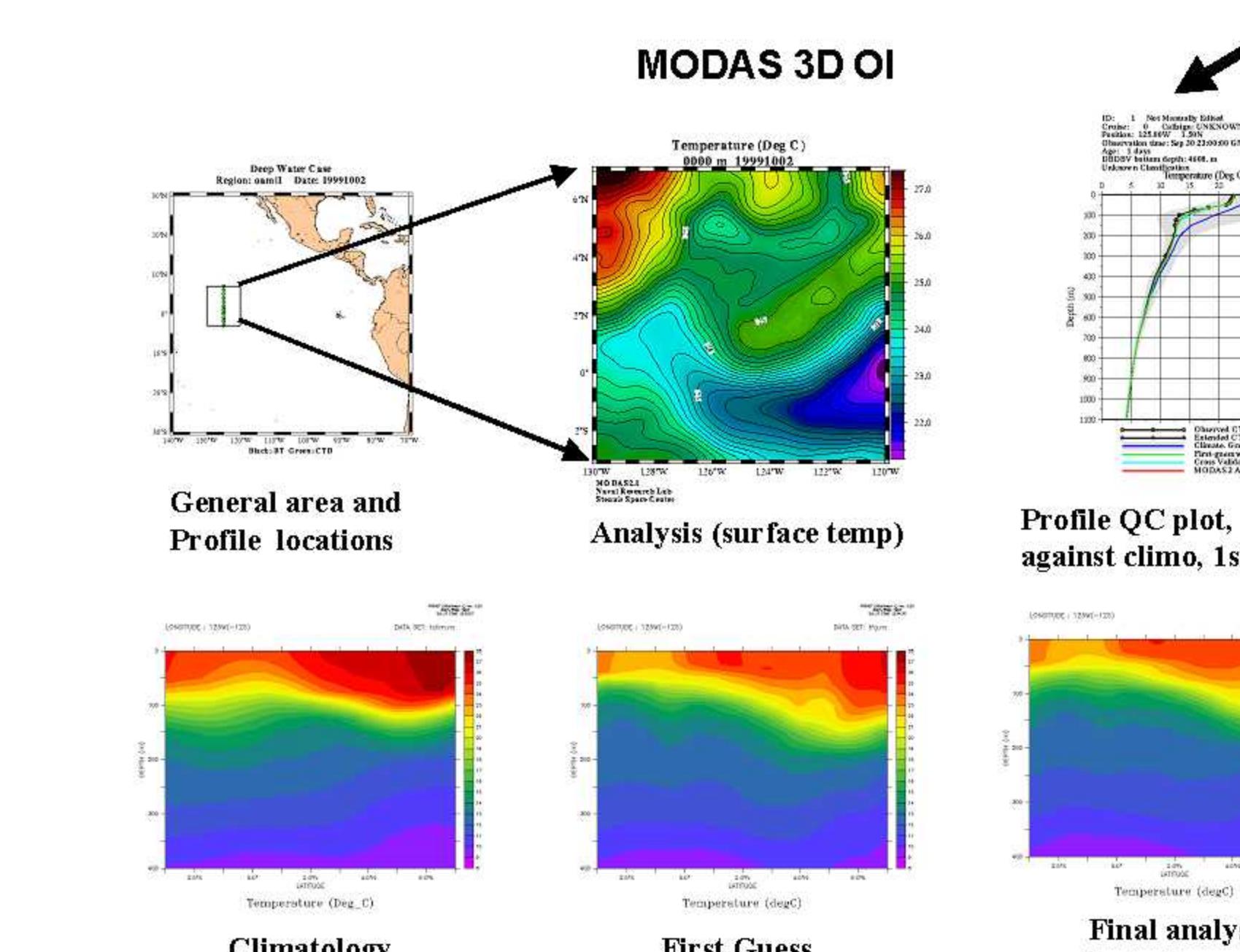
Mean, standard deviation and kinetic energy fields from 2001 of the 1/8° assimilative global NCOM experiment glb8_1g. The 2001 mean Gulf Stream and Kuroshio north wall positions from the NAVOCEANO operational IR-derived frontal bogus data are overlaid. For comparison, we include results from the climatological run glb8_1a for the Kuroshio region.



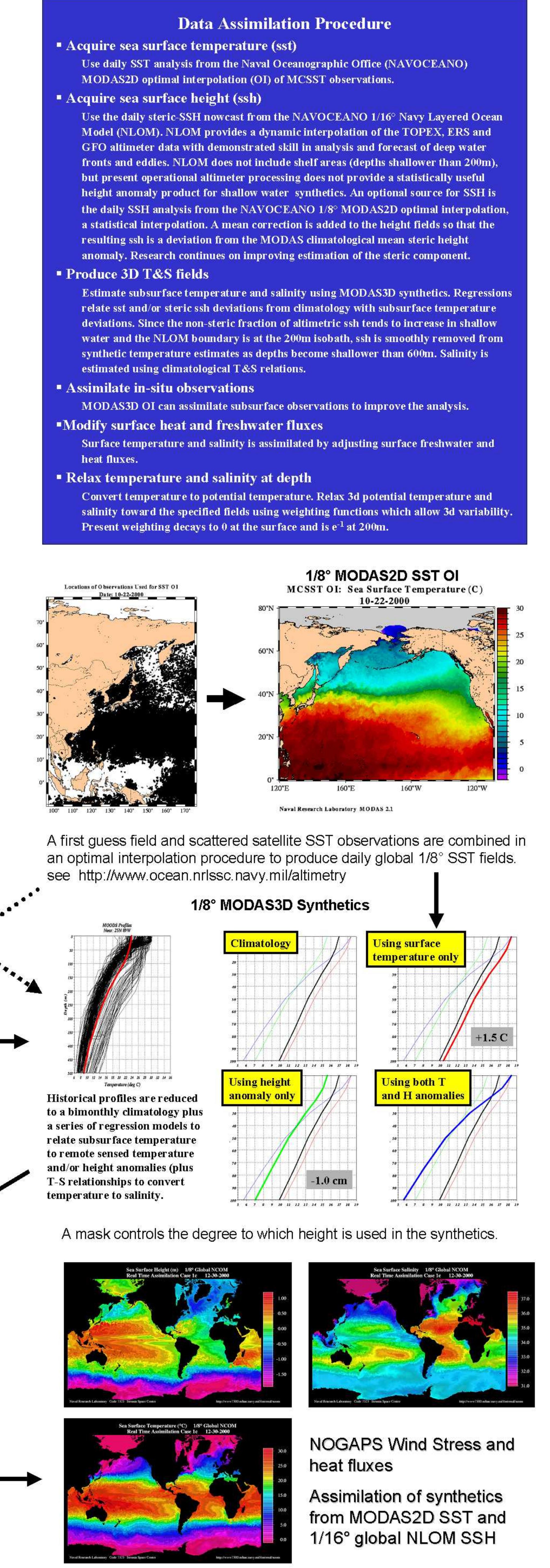
A first guess field and tracks of TOPEX, ERS and GFO sea surface height deviations are combined in an optimal interpolation procedure to produce daily global 1/8° SSH fields. See <http://www.ocean.nrlssc.navy.mil/altimetry>



Assimilating altimeter heights and MODAS2D sst, 1/16° NLOM provides an alternate source for steric heights in MODAS3D.



Additional in situ observations may be assimilated in this stage.



After regidding to the model grid, capping at the pole and adjusting for vertical stability, the data is nudged into the model according to the weighting field.