Data Assimilation Schemes
Inter-comparison Experiment

- The purpose of this experiment is to compare the assimilation outcomes of the systems being developed for HYCOM in the NOPP GODAE project

- Assimilation Systems:
  - ENOI  L. Bertino / F. Counillon
  - EnKF   H. Ngodock
  - MVOI  J. Cummings / O.M. Smedstad
  - ROIF  T. Chin / A. Srinivasan
  - SEEK (?
  - NCEP  C. Lozano
Domain and Model Configuration

- Forecast Model: HYCOM-2.1.36
- Domain: Gulf of Mexico
- Assimilation Time Period: 2004 through 2005
- Atmospheric Forcing: COAMPS (27 or 9 km)
- River Inputs: USGS (for US rivers only)
Evaluation Criteria for the assimilation runs

- Skill of the forecasts issued from the different analysis initial conditions out to 7 to 15 days, as measured by anomaly correlation and forecast of yet-to-be-assimilated observations

- Skill of the Nowcasts as compared to the free run of the model

- Performance measures of the assimilation system based on time series of the innovations and the residuals

- Skill of the assimilative lateral boundary conditions for downscaling to nested models in the NOPP CODAE experiment

- Prediction of unassimilated observations

- Prediction of loop current and loop current eddy locations

- Evaluate the consistency of the assimilative model runs with our knowledge of the oceanography of the Gulf of Mexico
A pilot study on data assimilation techniques comparison

- Identical Twin Experiments

- Assimilation Schemes:
  1) OI/Cooper-Haines (SLA & SST)
  2) NCODA (SLA & SST)
  3) ROIF (SLA)
  4) ENOI (SLA)

- Model: HYCOM-2.1.36
- Domain: Gulf of Mexico
- Assimilation Time Period: 1999 through 2000
- Atmospheric Forcing: FNMOC
- Nested within the 1/12 N. Atlantic System
HYCOM Identical Twin SSH and SST Data

Ocean model sampled along observed tracks

Ocean model sampled at observed MCSST locations

1/25° Gulf of Mexico HYCOM

Smedstad et al.
SSH Aug 30,1999 00Z (Analysis Day 2)

TRUTH

Oi/Atlantic-System

NCODA

ROIF
Temperature zonal sec. 25.08°N Oct 18, 1999 00Z (Analysis - Day 50)

TRUTH

OI/Atlantic-System

NCODA

ROIF
Salinity zonal sec. 25.08°N Aug 30, 1999 00Z (Analysis - Day 2)

TRUTH

OI/Atlantic-System

NCODA

ROIF
HYCOM Identical Twin Results
Vertical Profiles (0-500m)

29 August 1999

18 October 1999

RMS error (50.4)
Mean error (50.4)
Mean and RMS ERRORS (ROIF)
Aug 30, 1999 Analysis Day-2

Oct 18, 1999 Analysis Day-50
The “HYDAE” Data Server

- The data management group is putting together a dedicated server called “HYDAE Data Server” along the lines of GODAE server to facilitate this experiment with the following features:
  - Basic data access and visualization
  - access to all data via OPeNDAP
  - arbitrary 4D data subsets in NetCDF
  - download any of the raw files via FTP
  - access to boundary conditions in native hycom format.
  - able to visualize any of the fields from any of the models on any principle planes or axes
    - lat-long maps
      - at surface
      - at constant depth
      - along layers
    - vertical sections (lat-depth/layer, long-depth/layer)
    - time series
    - vertical profiles
    - Hofmuller plots of time versus lat, lon or depth axes
  - Comparison capabilities
  - visual comparison:
    - ability to create arbitrary "image spreadsheets" to compare the ensemble of model outputs in any of the views discussed above
  - difference (anomaly):
    - able to compute differences between any two model runs and visualize in any of the ways described above.