## Real Time Sea State Forecast

**Princeton Ocean Model (POM)** : It is a primitive equation, ocean general circulation model with sigma levels for the vertical coordinate system. It is configured for the Indian Ocean. The model domain extends from $20^o$ S to $25^o$ N and $40^o$ E to $100^o$ E. The horizontal resolution of the model has been set to 0.5 X 0.5 deg.

**Model Forcing**: Model is forced by daily fields of net shortwave and longwave radiation, precipitation, specific humidity and wind fields from National Center for Medium Range Weather Forecast (NCMRWF)

**Outputs**: The output from the model includes mixed layer depth, sea surface anomaly, sea surface current, sea surface salinity and sea surface temperature.

**Assimilation Technique**: Assimilation method used is Ensemble Optimal Interpolation technique where the ensemble members are to be selected from a historical run of the model and the ensemble is stationary. For the study the weekly model states from the historical run for the years 2005 to 2007 are used to create the static ensemble.

**Data Sets used for Assimilation**: Merged product of all available altimeters Sea Level Anomaly and NOAA AVHRR SST.

**Model prognostic variables**: Sea surface height and temperature, salinity, zonal and meridional currents at each vertical level.

**Operational Set up**: Assimilation datasets of altimeter and AVHRR SST are available by 3 and 2 days lag and hence the forecast cycle starts from 3 days prior to the current day. Assimilation of SLA and SST is performed according to the availability of the datasets.

**Validation data set**: POM model analysed and forecasted sub surface salinity and temperature are compared with RAMA buoy data.

**Validation Time**: Model validation is done for the month of September for both analyzed and forecasted variables.

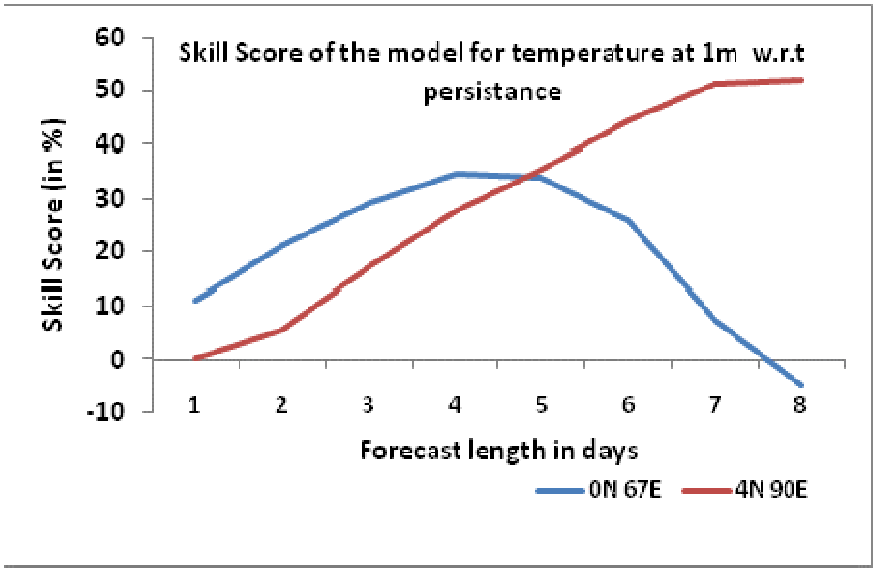
## Error Statistics in model analysed salinity (psu) at different depths

| | Depth (m) | | | | | |
|---|---|---|---|---|---|---|
| RAMA buoy Stations | 1 | 10 | 20 | 40 | 60 | 100 |
| | RMSE(BIAS) | RMSE(BIAS) | RMSE(BIAS) | RMSE(BIAS) | RMSE(BIAS) | RMSE(BIAS) |
| 0N 67E | 0.24(0.02) | 0.22(0.05) | 0.17(0.12) | 0.11(0.45) | 0.07(0.73) | 0.12(0.62) |
| 15N 90E | 0.35(-0.94) | 0.4(-0.87) | 0.36(-0.85) | 0.34(-0.92) | 0.28(-0.86) | 0.35(-0.24) |
| 0N 80.5E | 0.07(-0.2) | 0.08(-0.23) | 0.07(-0.22) | 0.08(-0.18) | 0.04(-0.08) | 0.1(0.69) |
| 4S 67E | 0.13(0.36) | 0.1(0.41) | 0.1(0.42) | 0.11(0.47) | 0.08(0.48) | 0.03(0.2) |

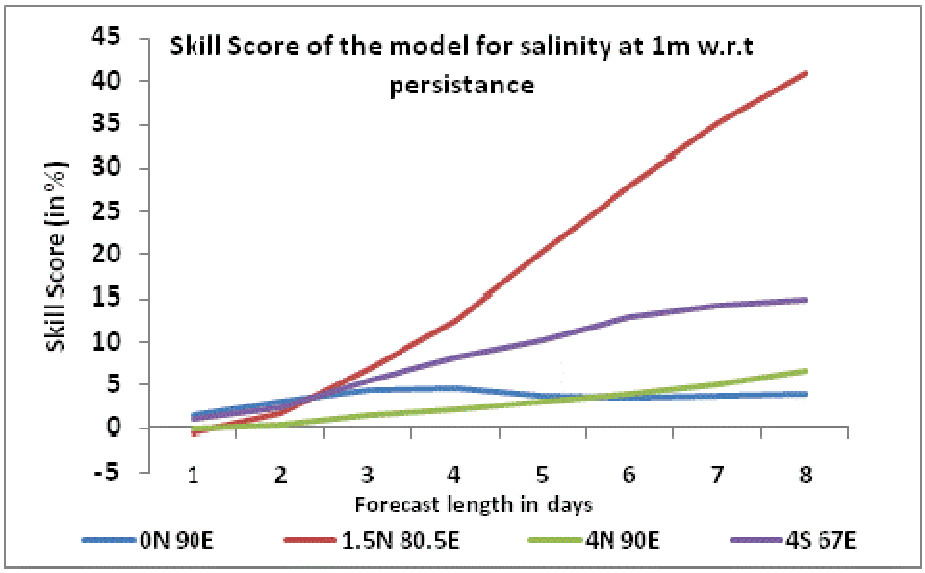
## Error Statistics in model analysed temperature (deg C) at different depths

| | Depth (m) | | | | | |
|---|---|---|---|---|---|---|
| RAMA buoy Stations | 1 | 10 | 60 | 100 | 300 | 500 |
| | RMSE(BIAS) | RMSE(BIAS) | RMSE(BIAS) | RMSE(BIAS) | RMSE(BIAS) | RMSE(BIAS) |
| 0N 67E | 0.29(-0.44) | 0.3(-0.5) | 0.62(0.07) | 0.79(0.93) | 0.23(3.0) | 0.16(4.5) |
| 12N 90E | 0.34(0.17) | 0.29(0.15) | 0.88(1.6) | 0.44(1.7) | 0.15(3.2) | 0.11(3.8) |
| 0N 80.5E | 0.29(-0.01) | 0.27(-0.09) | 0.49(2.9) | 1.1(0.16) | 0.29(3.1) | 0.3(4.1) |
| 4S 67E | 0.36(-0.38) | 0.42(-0.49) | 0.93(-0.4) | 0.6(-1.23) | 0.16(3.6) | 0.15(4.6) |

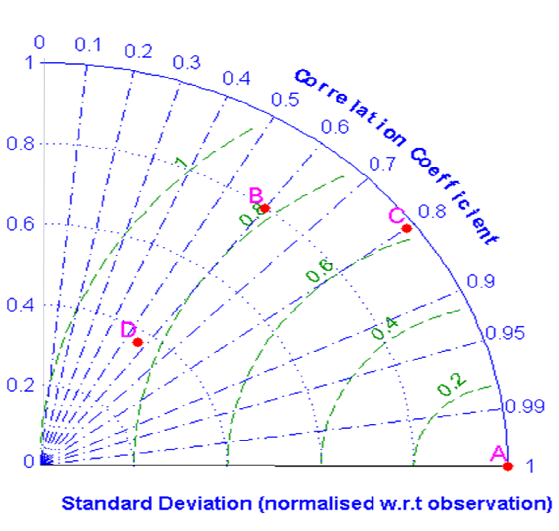
**Performance of the model forecasted temperature (deg C) at 1m depth at RAMA buoy locations**



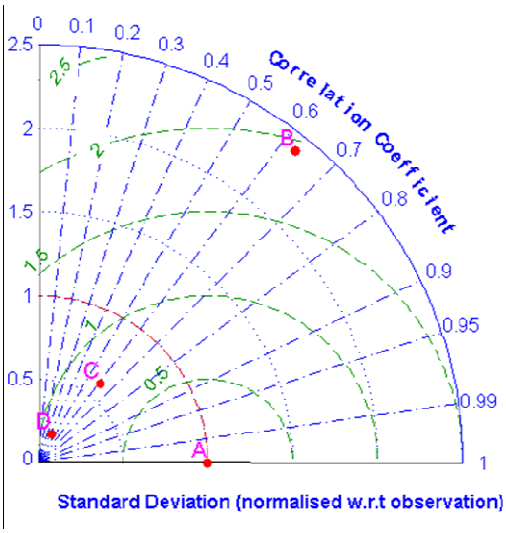

**Performance of the model forecasted salinity (psu) at 1m depth at RAMA buoy locations**



**Error Statistics of model forecasted temperature(left) and salinity (right) at 1m depth shown by Taylor Diagram.**




A- RAMA ; B- 1.5N 80.5E; C-15N 90E; D-1.5S 67E




A- RAMA ; B- 12N 90E; C-1.5S 67E; D-4S 67E

**The radial distance from the origin is proportional to the standard deviation of a pattern. The CRMSD between the model and RAMA buoy field is proportional to their distance apart (in the same units as the standard deviation). The correlation between the two fields is given by the azimuthal position of the model field.**