The model used is recent version of Geophysical Fluid Dynamics Laboratory (GFDL), Modular ocean model version 6 (MOM6) is a hydrostatic, primitive equation, free surface,Boussinesq ocean model with ALE vertical grid remapping to use any kind of vertical coordinates and generalized orthogonal horizontal coordinates. Equations governing ocean dynamics and thermodynamics are discretized on a fixed eulerian grid, with Arkawa C grid defining the horizonatal arrangement of model variables.

Model Grid and Domain

The model setup has a uniform horizontal resolution 0.036 degrees in longitude and 0.036 degrees in latitude and model domain covers the bay of bengal between latitudes 4N to 25N and longitudes 77E to 99E. For simulating with closed boundaries, the area between latitudes 4N and 4.5 N is closed with fake rigid wall. Model topography is based on 1-min resolution ETOPO1 dataset with minimum depth of ocean as 5m and maximum depth of 5000m.

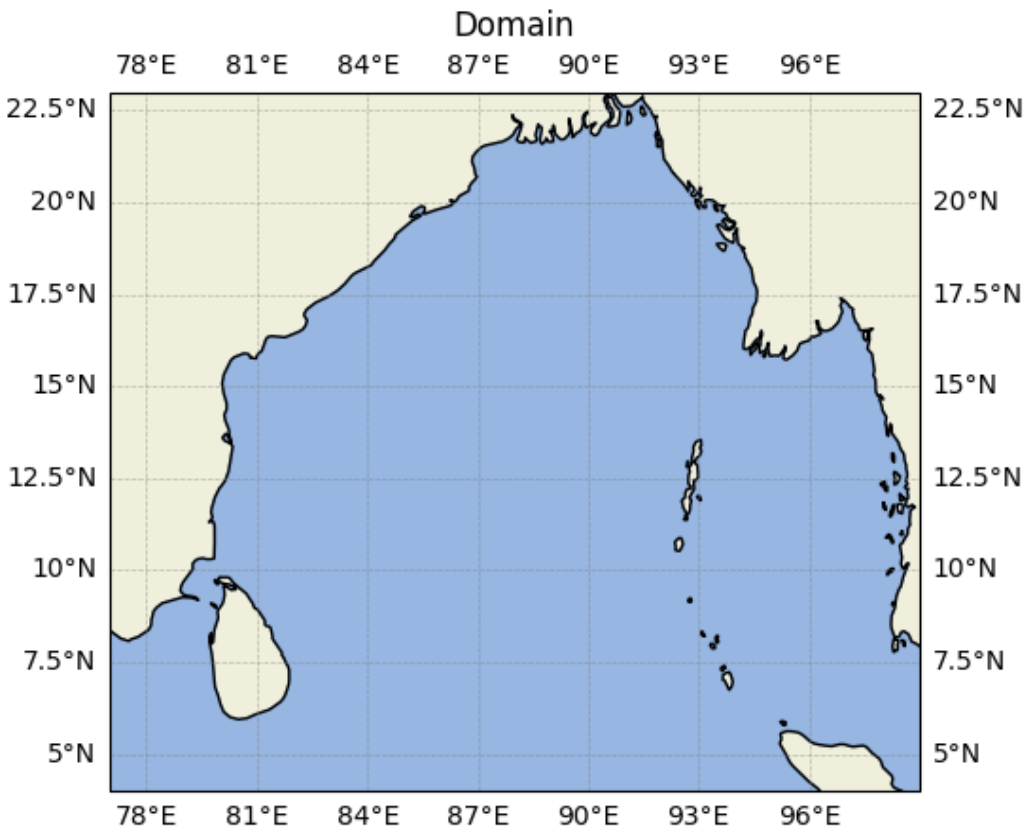


Figure 1: Domain

The model has 41 vertical levels (HYCOM) and spacing gradually increases up to 5000m and MOM6's vertical lagrangian remapping enabled for using any kind of coordinates.

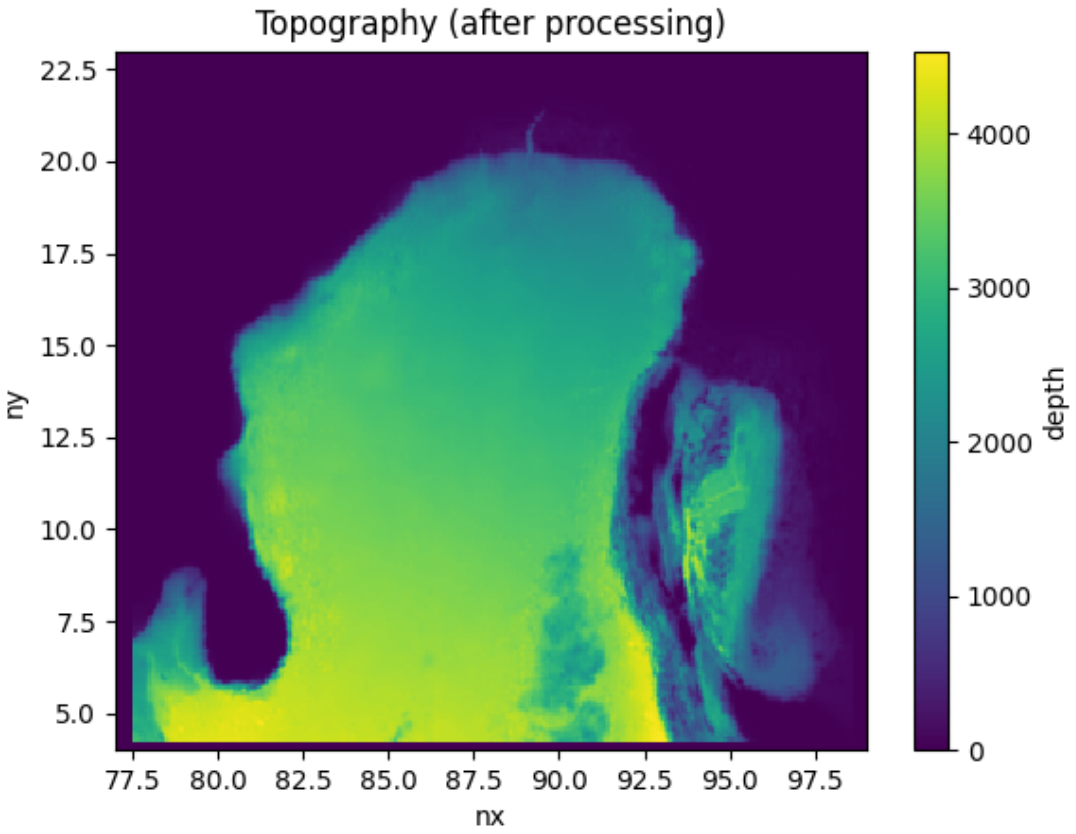


Figure 2: Model Topography

All 4 sides are treated as solid rigid walls among them southern wall is fake rigid boundary. The bottom topography is based on new version of ETOPO (ETOPO version 1).

Field	Data Source	References	Frequency
Air Temperature (K)	ERA 5 Interim reanalysis	The ERA5 Global Reanalysis Hersbach, H. et al. May 2020. QJRMS	daily
Short wave Downward flux (W/mˆ-2)	ERA 5 Interim reanalysis	The ERA5 Global Reanalysis Hersbach, H. et al. May 2020. QJRMS	daily

Field	Data Source	References	Frequency
Longwave downward flux (W/mˆ-2)	ERA 5 Interim reanalysis	The ERA5 Global Reanalysis Hersbach, H. et al. May 2020. QJRMS	daily
Specific Humidity	ERA 5 Interim reanalysis	The ERA5 Global Reanalysis Hersbach, H. et al. May 2020. QJRMS	daily
10m U wind (m/s)	ERA 5 Interim reanalysis	The ERA5 Global Reanalysis Hersbach, H. et al. May 2020. QJRMS	daily
10m V wind (m/s)	ERA 5 Interim reanalysis	The ERA5 Global Reanalysis Hersbach, H. et al. May 2020. QJRMS	daily
Precipitation	ERA 5 Interim reanalysis	The ERA5 Global Reanalysis Hersbach, H. et al. May 2020. QJRMS	daily
Runoff flux	GRUN	GRUN: An observations-based global gridded runoff dataset from 1902 to 2014	monthly
Sea Level Pressure	ERA5 interim reanalysis	The ERA5 Global Reanalysis Hersbach, H. et al. May 2020. QJRMS	daily

Model Physics options

Among a number of options available in MOM6 the following options are choosed for this model setup, McDougall et al. [2003] nonlinear equation of state has been used, with in situ density as a function of the local potential temperature, salinity and hydrostatic pressure. The tracer advection scheme is the Quicker scheme documented by Holland et al. [1998]. Neutral tracer physics includes Redi neutral diffusion according to Griffies et al. [1998],and Gent-McWilliams stirring according to the Griffies [1998] skew-flux method. Vertical mixing scheme is the KPP scheme of Large et al. [1994] with nonlocal mixing

The turbulent heat fluxes (sensible and latent heat flux) and the upward longwave flux are calculated as a function of model SST.Temperature and salinity are allowed to evolve freely without any restoration to climatological values

Forcing

Forcing datasets derived from The ERA5 Global Reanalysis Hersbach, H. et al. May 2020. QJRMS and observational global runoff data (GRUN) *[Ghiggi, G., Humphrey, V., Seneviratne, S. I., and Gudmundsson, L.: GRUN: an observation-based global gridded runoff dataset from 1902 to 2014, Earth Syst. Sci. Data, 11, 1655–1674, https://doi.org/10.5194/essd-11-1655-2019, 2019.]* . More about the forcing data is listed in the table 1

The model spin up was started with Initial conditions from HYCOM high resolution model output (HYCOM) with SST,U,V currents and SSS from 1 st January 2012. The model is forced by daily climatology derived from ECMWF reanalysis for the period 2012-2013. The sea-ice ,land and atmospheric components are turned on for all model runs. The first year (2012) is considered as cold run while the second year model is assumed to be stable.

Model Outputs (2012-2013,with river runoff)

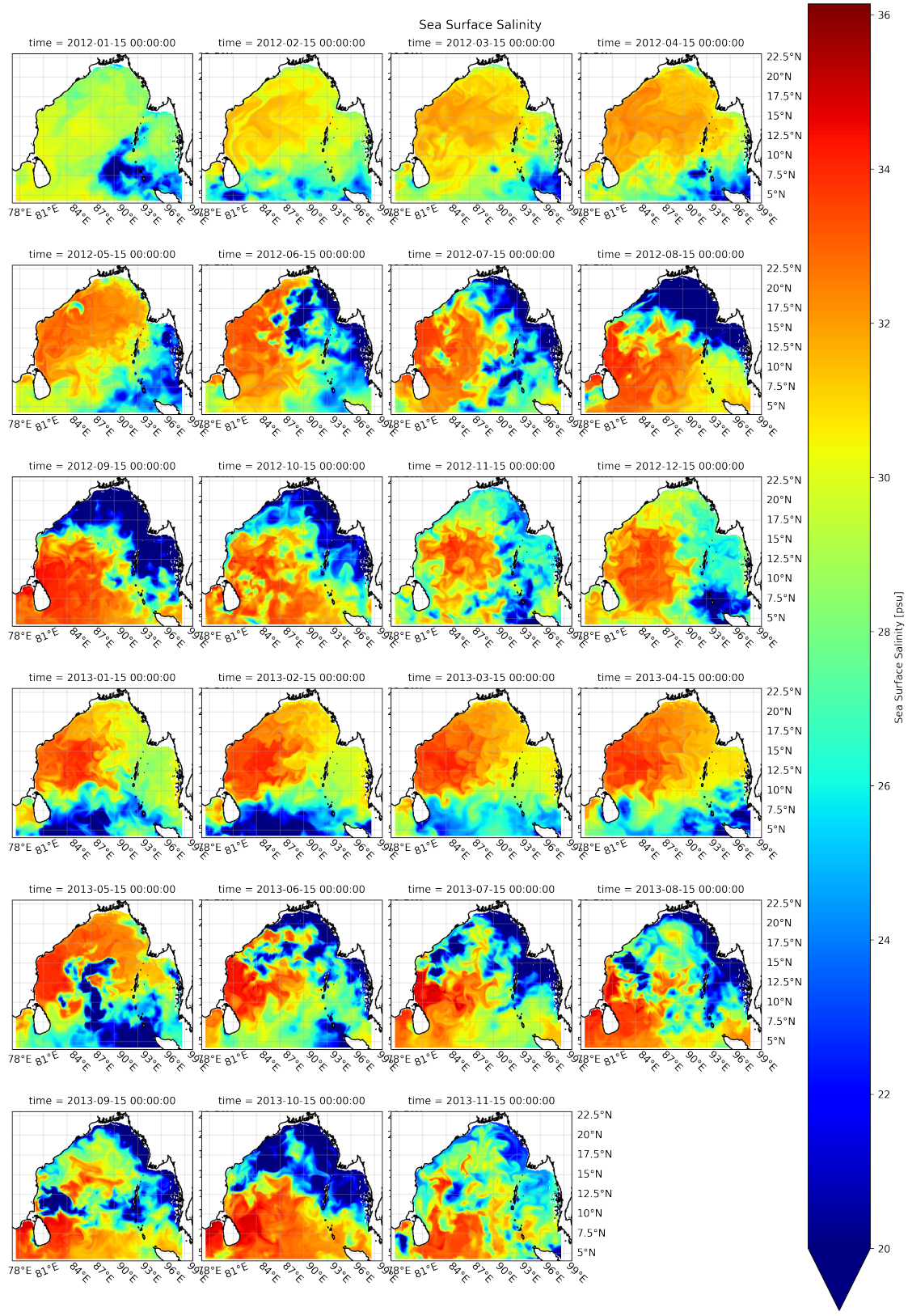


Figure 3: Monthly Salinity

Comparison plots and analysis

> T_25 is the observational SST

Compared locations

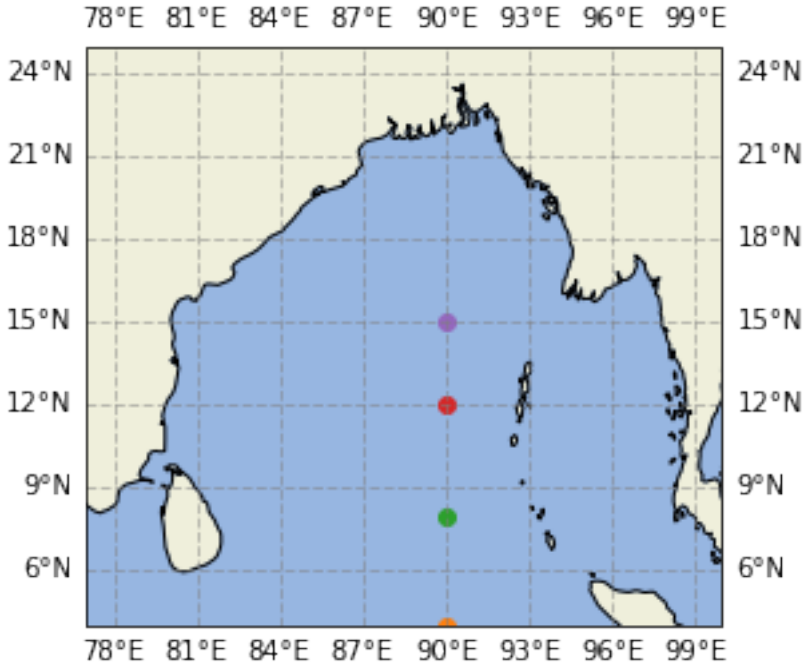


Figure 4: Locations of interest (RAMA)

1st location

Temp

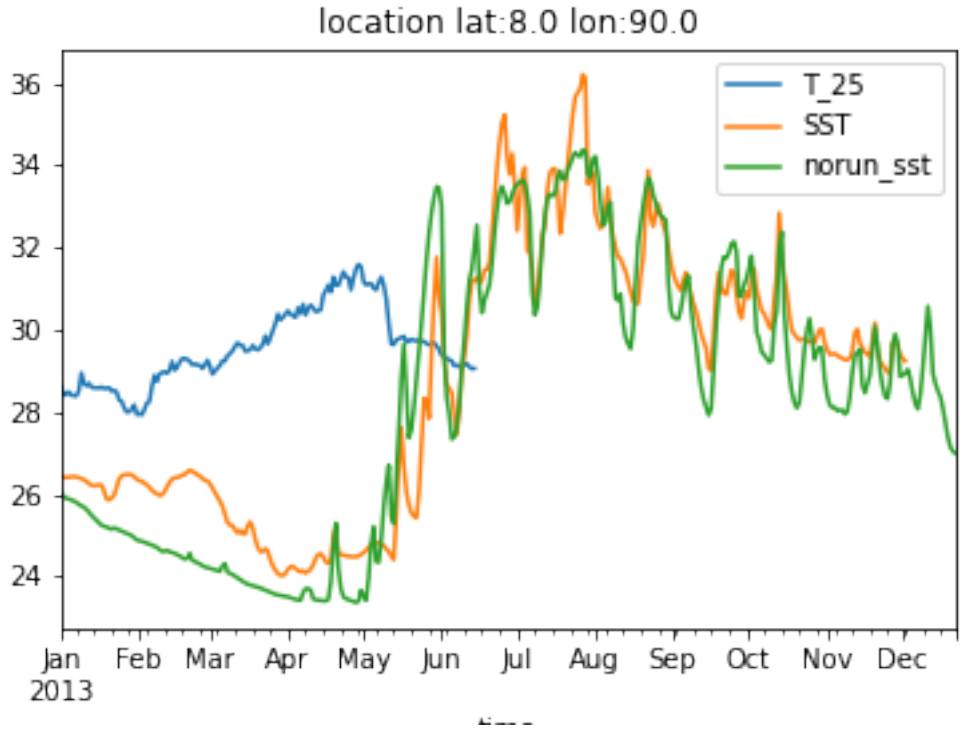


Figure 5: SST time-series

	T_25	SST	norun_sst
T_25	1.000000	-0.481060	-0.215725
SST	-0.481060	1.000000	0.951776
norun_sst	-0.215725	0.951776	1.000000

Figure 6: Correlation Table

Salinity

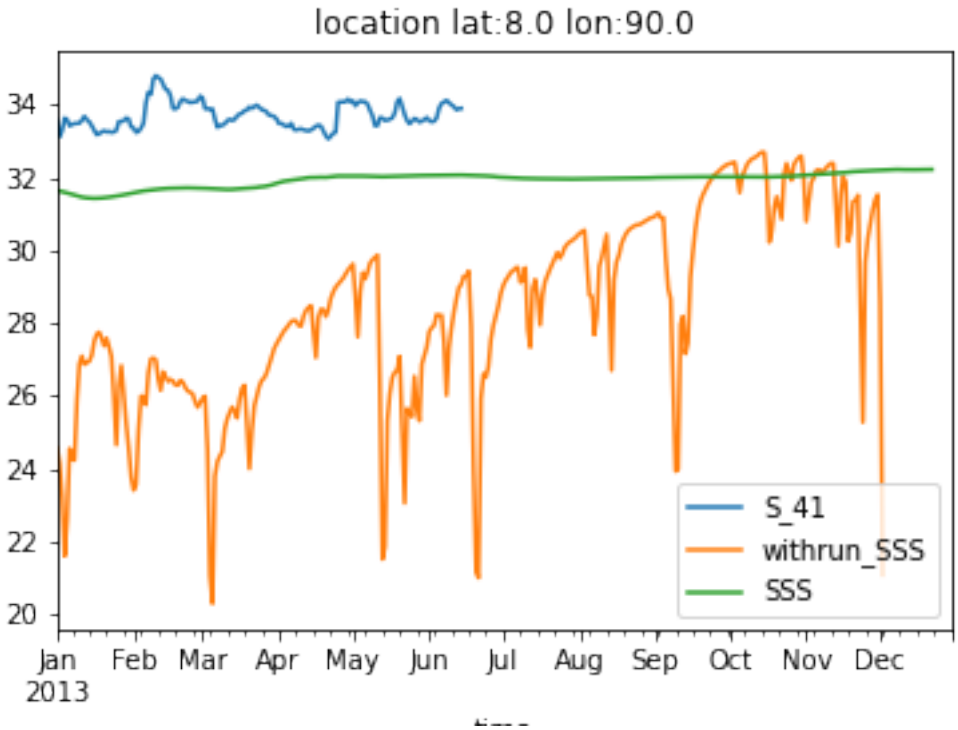


Figure 7: SSS Time-series

U current

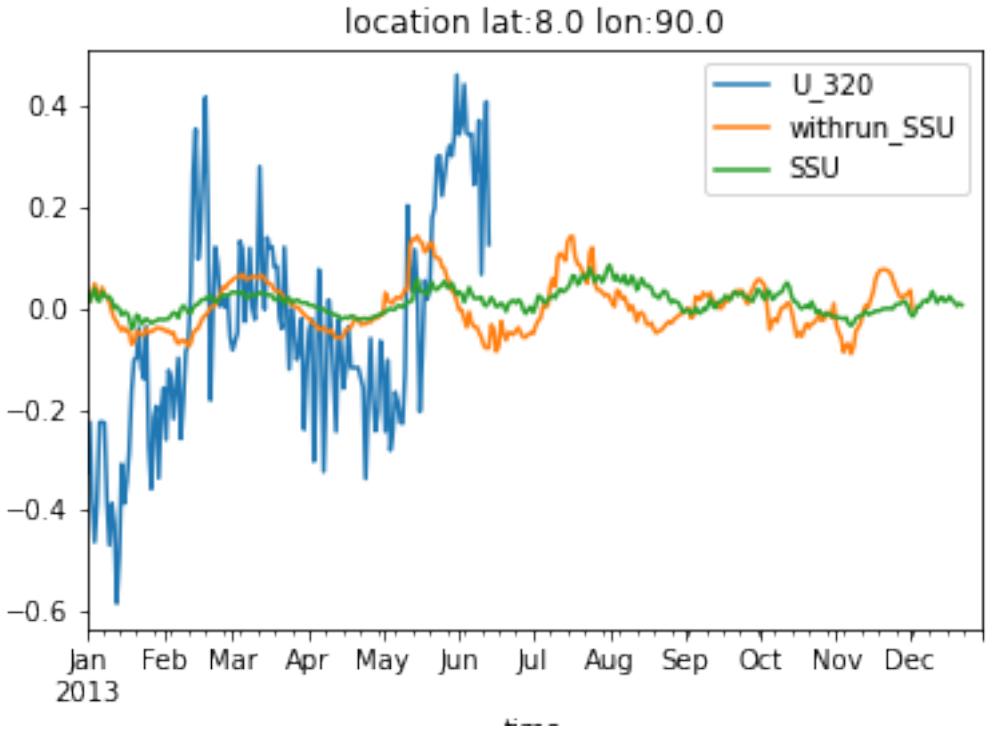


Figure 8: U current Time series

V current

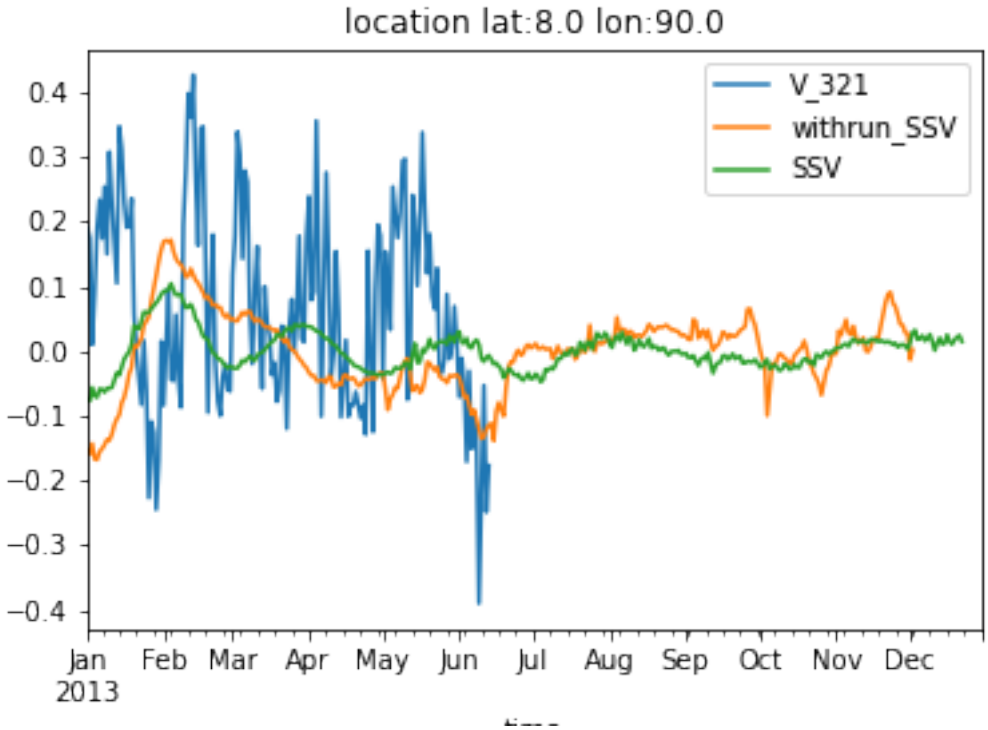
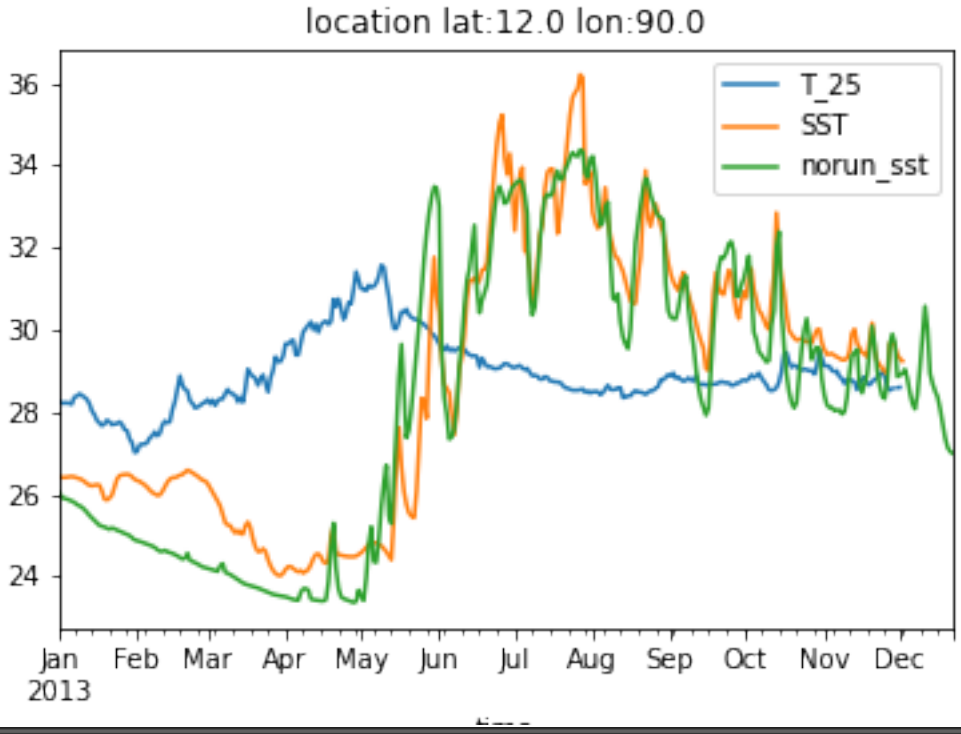


Figure 9: V current Time series

2nd location

Temp



	T_25	SST	norun_sst
T_25	1.000000	-0.220329	-0.069891
SST	-0.220329	1.000000	0.951776
norun_sst	-0.069891	0.951776	1.000000

Salinity

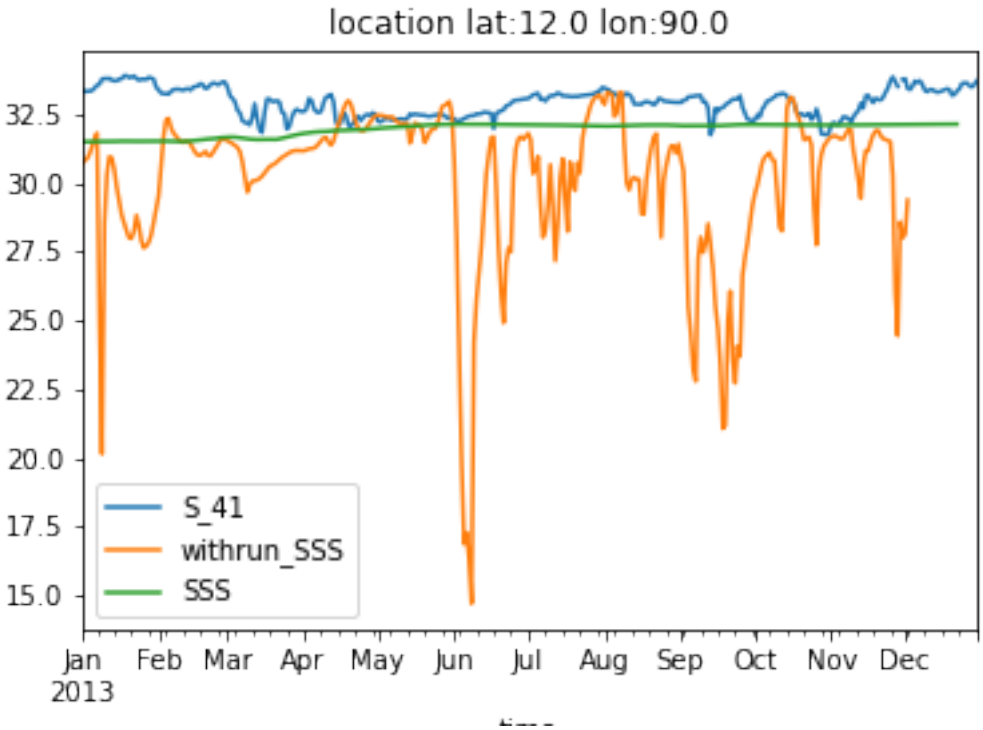


Figure 10: SSS Time-Series

U current

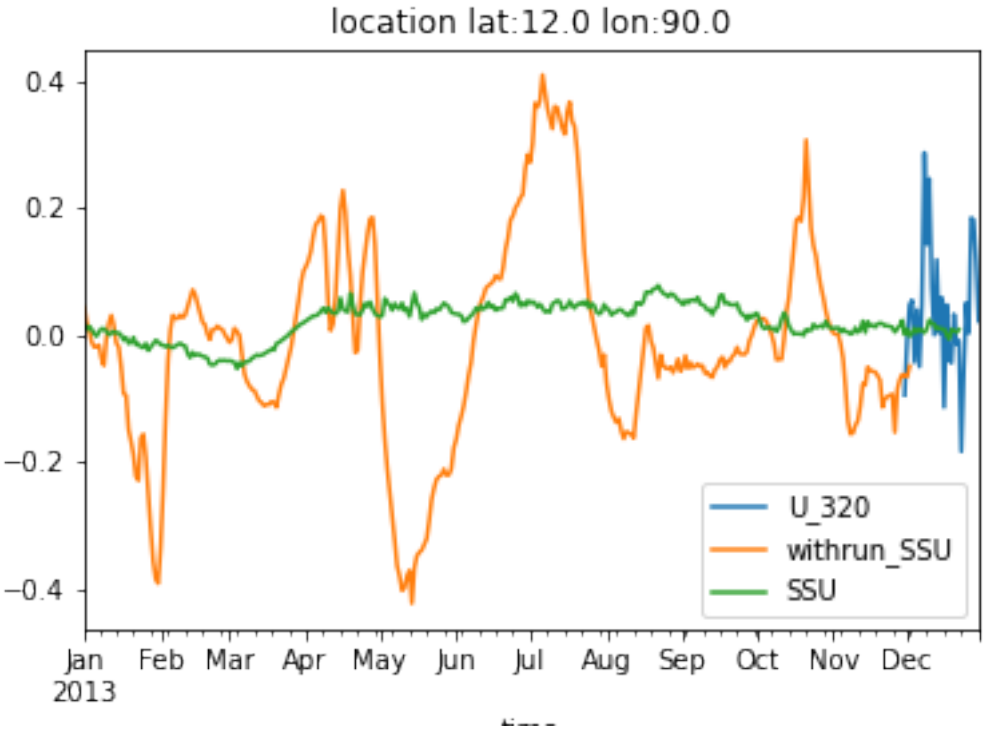


Figure 11: U current Time series

Vcurrent

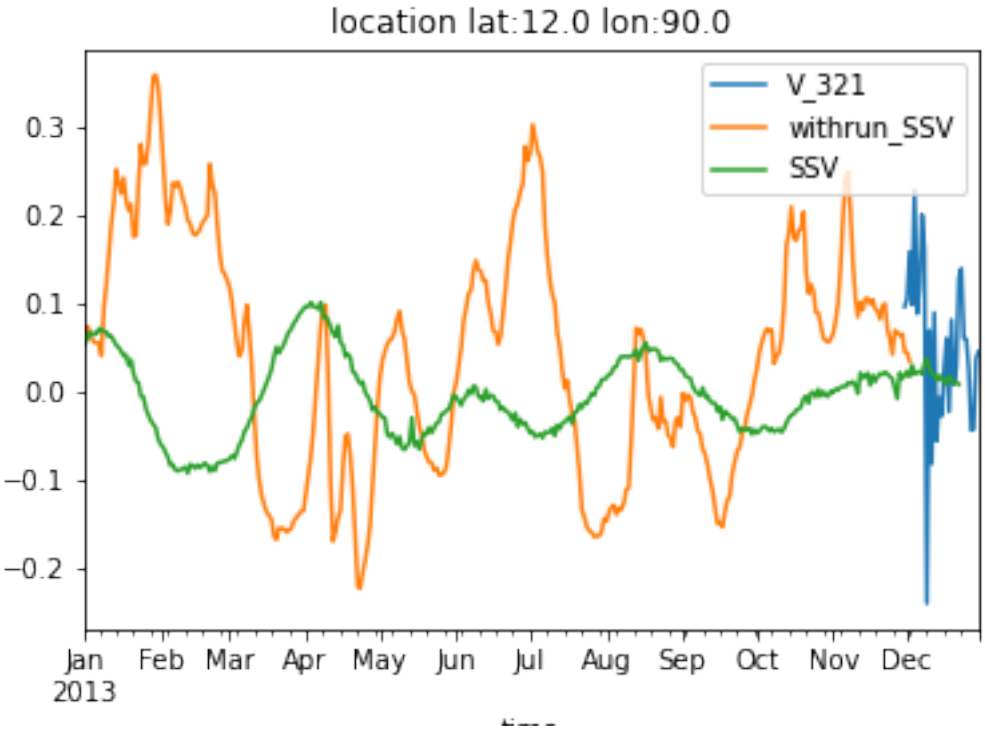
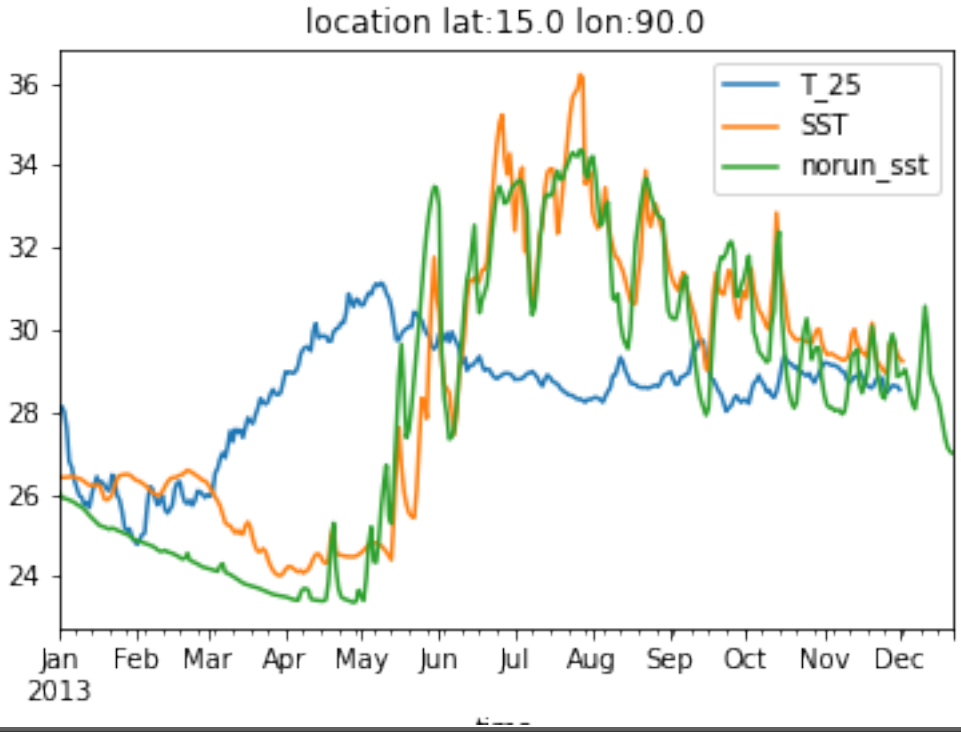


Figure 12: V current Time series

3rd location

Temp



	T_25	SST	norun_sst
T_25	1.000000	0.140384	0.272010
SST	0.140384	1.000000	0.951776
norun_sst	0.272010	0.951776	1.000000

Salinity

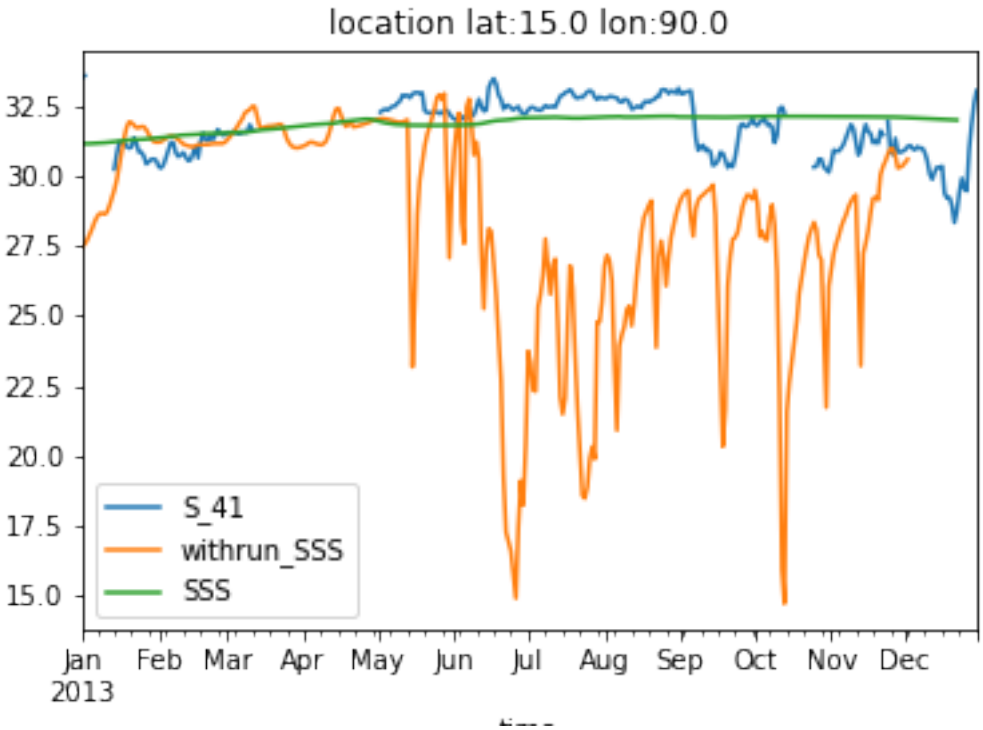


Figure 13: SSS Time-series

U current

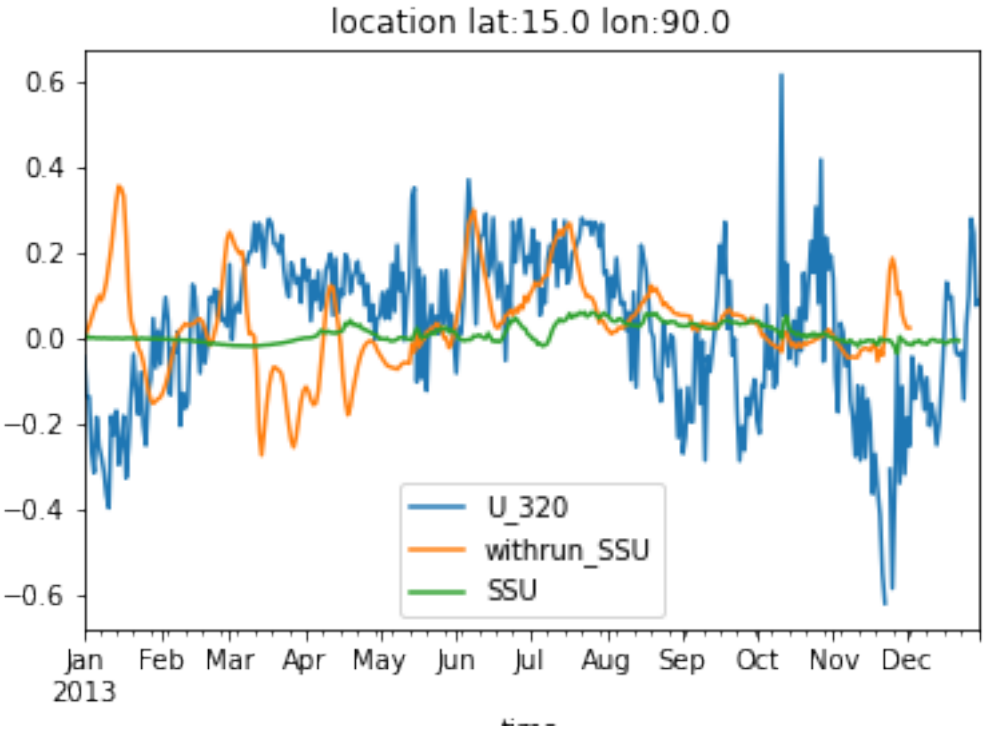


Figure 14: U current Time series

V current

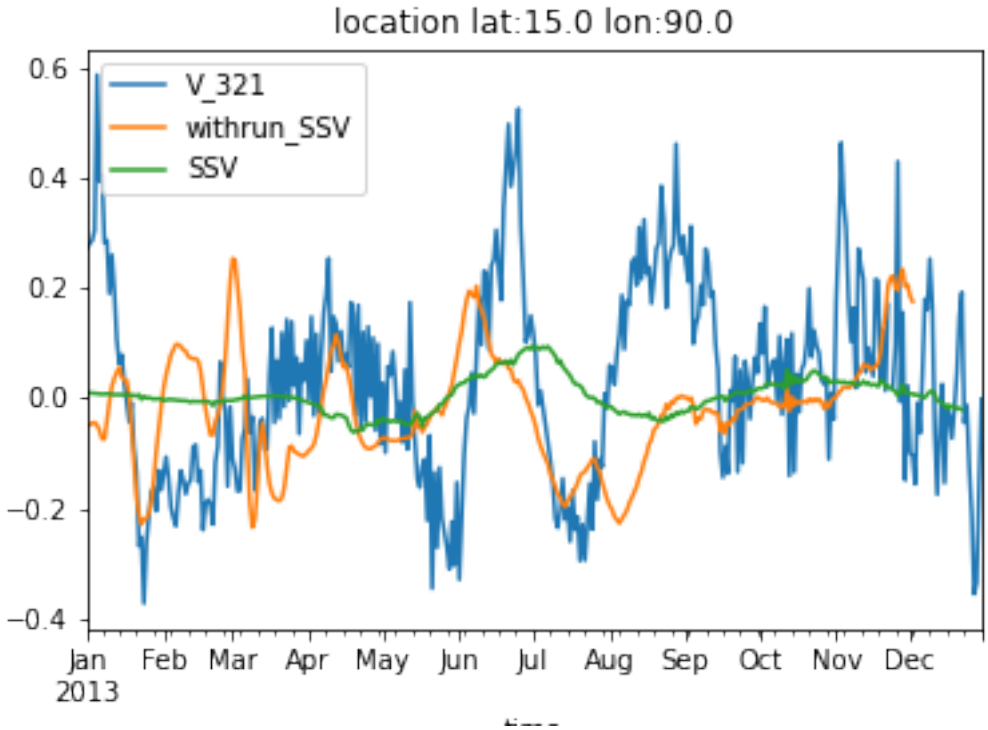


Figure 15: V current Time series

- overall an negative correlation between observational and model output SST
- Comparitively simulations with river runoff (and precipitation) are more closer to the observed values.
- after Jun/July the model values start to approach observational values
- Even the values are close, poor correlation suggests model does not picking up the patterns
- A run for 6 or 7 year might make the model stable (2007-2013)
- The V and U current an acceptable positive correlation of 0.48