AS205:Ocean Dynamics(Assignment 6)

Parag Shende

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Introduction

We describe the seasonal means of the Ekman transport(M_x and M_y) and the Ekman pumping in the Bay of Bengal and Arabian Sea. This is undertaken to study the spatial and temporal patterns of the two basins. The seasonal means are constructed for the year 2022.

Datasets

The datasets used in this analysis is as follows:

- **Sea Surface Eastward stress** : ASCAT data.
- **Sea Surface Northward stress** : ASCAT data.

Methodology

The datasets are choosen for the domain of $40°E$ to $100°E$ and $0°N$ to $25°N$. This covers the North Indian ocean. We then calculate the seasonal mean with the following seasons:

- **Summer Monsoon** : June, July, August, September(JJAS)
- **Winter Monsoon** : November, December, January, February(NDJF)

The Ekman transport(M_x and M_y both in $\frac{kg}{ms}$) is calculated as follows:

$$M_x = \frac{\tau_y}{f}$$
$$M_y = \frac{-\tau_x}{f}$$

where, τ_x and τ_y are the wind stress(in $\frac{N}{m^2}$) in zonal and meridional direction respectively.
f is the coriolis parameter (in s^{-1}).
The Ekman velocity(w_E in m/s) is calculated as:

$$w_E = -\nabla \times \frac{\vec{\tau}}{\rho f}$$

where, ρ is the density of the water(taken to be $1035\frac{kg}{m^3}$)

Summer monsoon

Ekman transport

- The seasonal mean Ekman transport for summer is plotted in Figure 1 and 2.
- The zonal Ekman transport is maximum along the equator.
- The meridional Ekman transport is maximum along the Somali jet region.

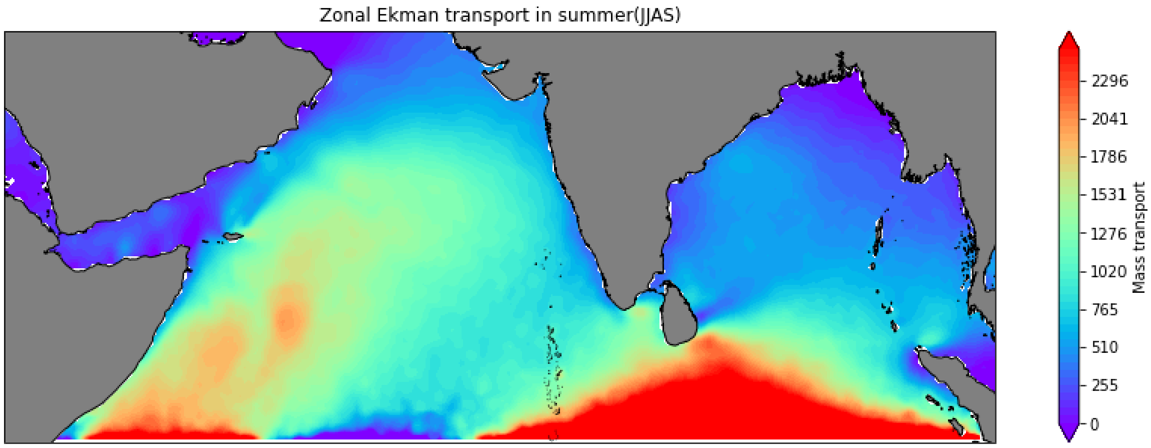

Figure 1: Zonal Ekman transport in summer in $kg/(ms)$

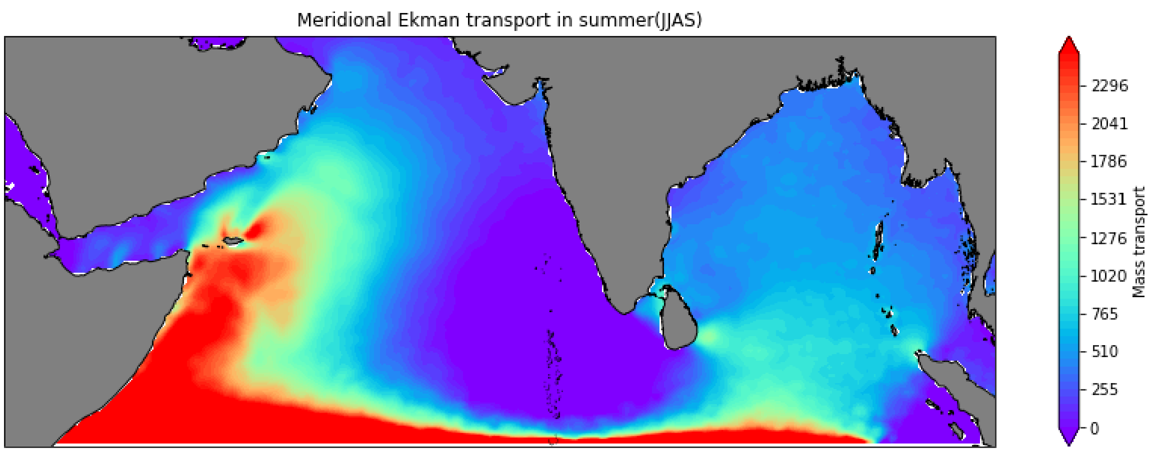

Figure 2: Meridional Ekman transport in summer in $kg/(ms)$

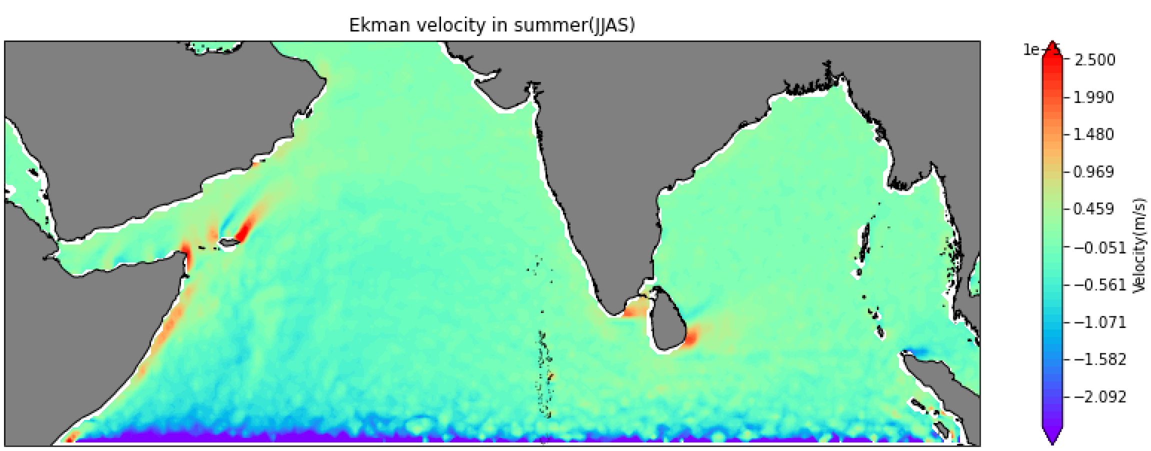

Figure 3: Ekman pumping in summer in m/s

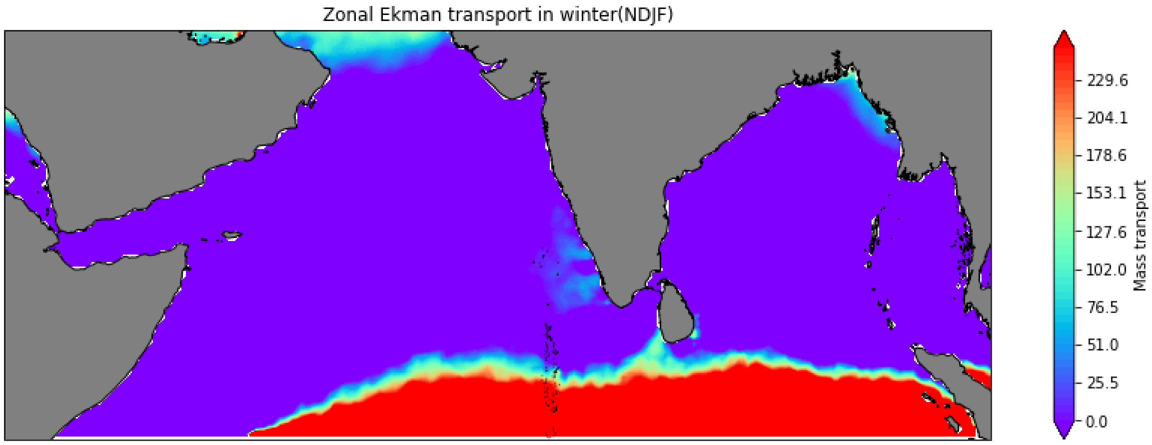

Figure 4: Zonal Ekman transport in winter in $kg/(ms)$

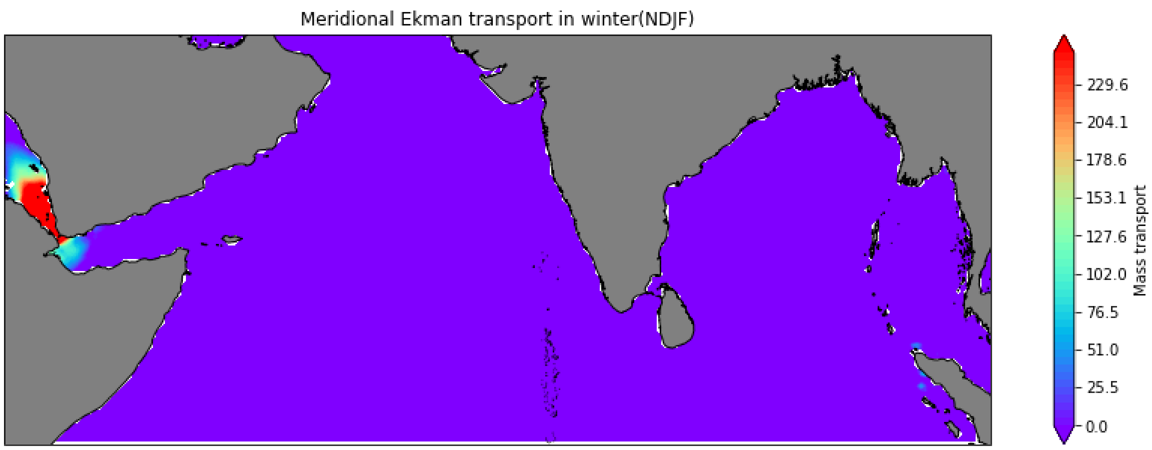

Figure 5: Meridional Ekman transport in winter in $kg/(ms)$

Ekman pumping

- The seasonal mean Ekman velocity for summer is plotted in Figure 3.
- There is downwelling along the equator.
- Most of the region is dominated by downwelling with isolated spots of upwelling like along Somali coast and eastern coast of Sri Lanka.

Winter monsoon

Ekman transport

- The seasonal mean Ekman transport for winter is plotted in Figure 4 and 5.
- There is a significant decrease in meridional Ekman transport in winter, this could be due to weakening of winds. This is majorily southwards.
- There is reduction in zonal Ekman transport in winter too owing to similar reason.

Ekman pumping

- The seasonal mean Ekman velocity for winter is plotted in Figure 6.

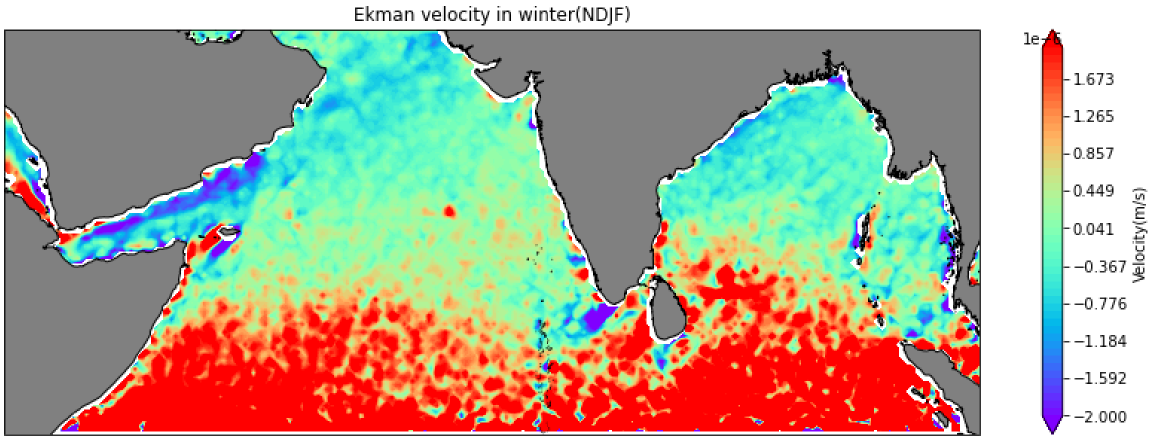

Figure 6: Ekman pumping in summer in m/s

- There is now upwelling along most of the Southern part of the domain and along equator.

Conclusions

- We compared the seasonal means of zonal and meridional Ekman transport for northern Indian ocean.
- Due to weakened winds there is a reduction in Ekman transport in winter.