Supplementary Figures-

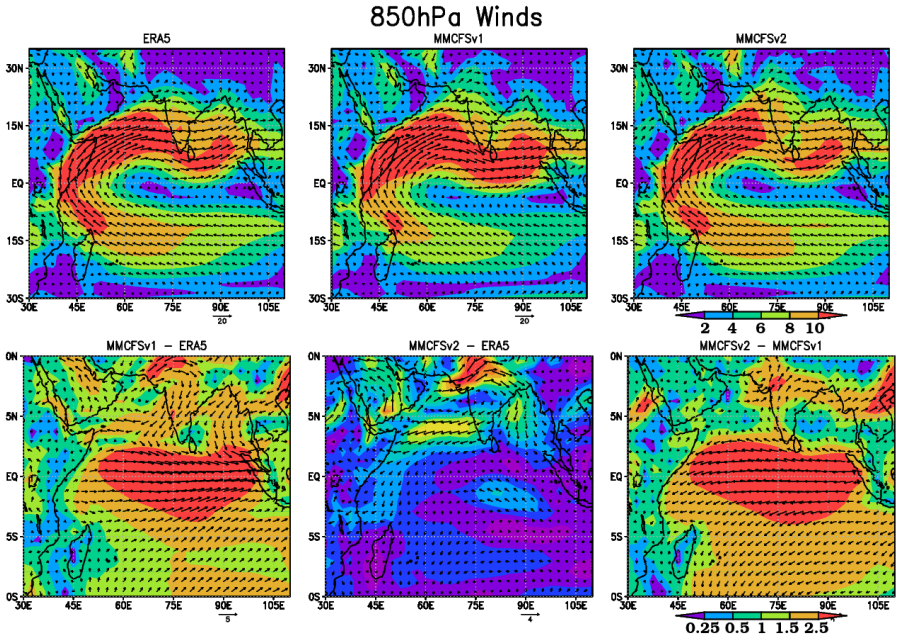

Figure 1a. 850hPa winds (vectors and shaded magnitude) from (a)ERA5 (b) MMCFSv1 © MMCFSv2, and biases (d) MMCFSv1 – ERA5 (e) MMCFSv2 – ERA5, difference between the model winds (f) MMCFSv2 – MMCFSv1

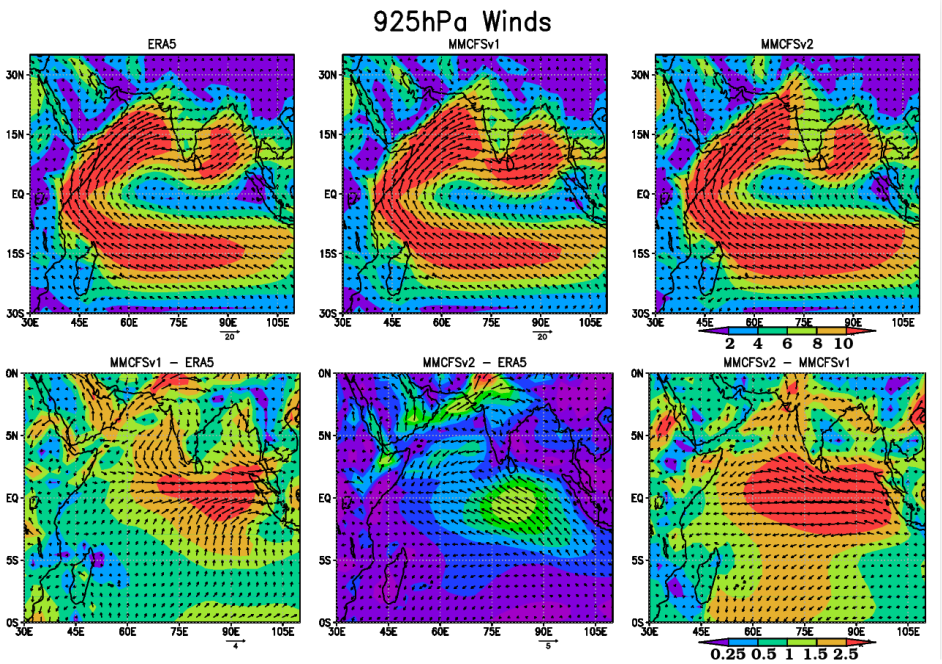

Figure 1b. 925hPa winds (vectors and shaded magnitude) from (a)ERA5 (b) MMCFSv1 © MMCFSv2, and biases (d) MMCFSv1 – ERA5 (e) MMCFSv2 – ERA5, difference between the model winds (f) MMCFSv2 – MMCFSv1

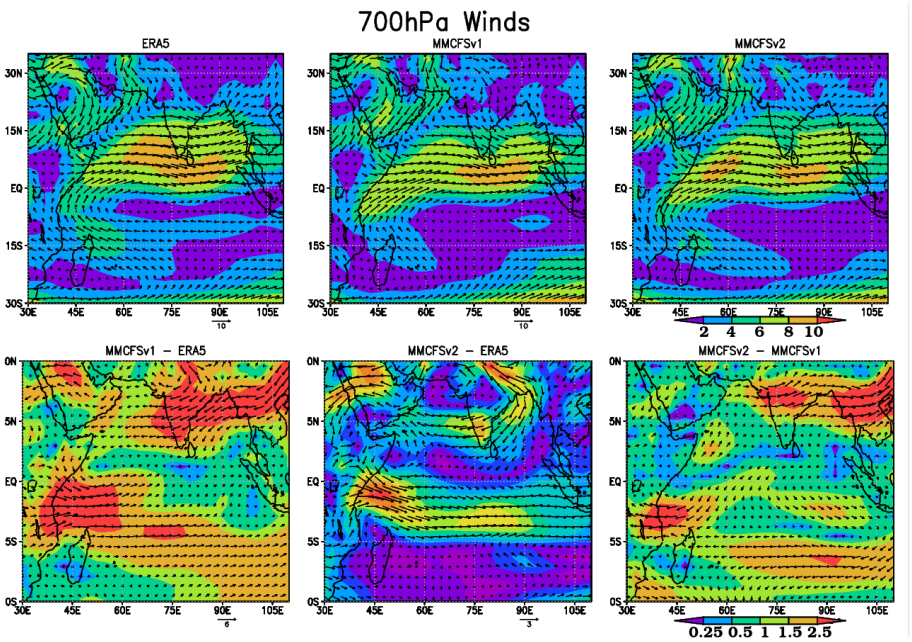

Figure 1c. 700hPa winds (vectors and shaded magnitude) from (a)ERA5 (b) MMCFSv1 © MMCFSv2, and biases (d) MMCFSv1 – ERA5 (e) MMCFSv2 – ERA5, difference between the model winds (f) MMCFSv2 – MMCFSv1

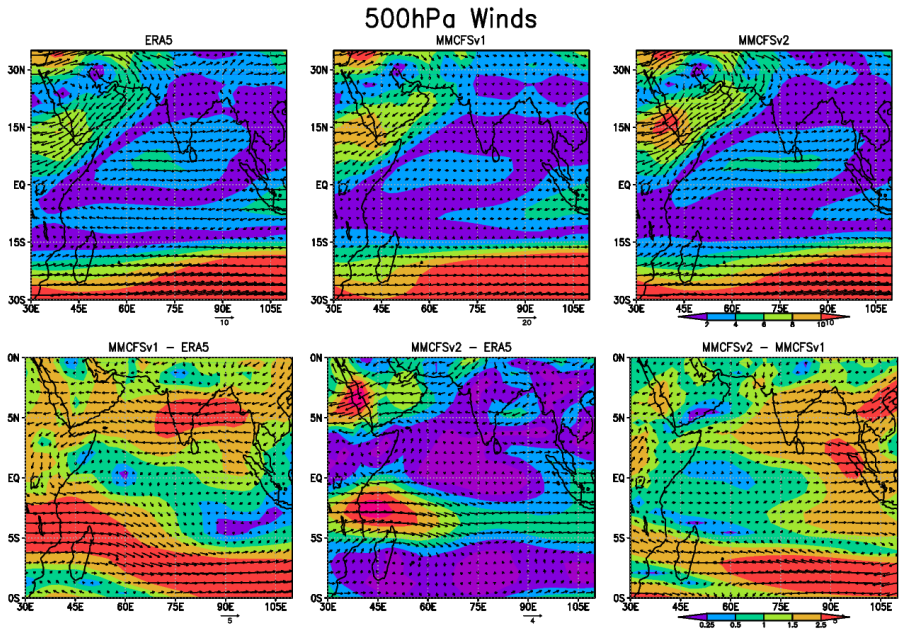

Figure 1d. 500hPa winds (vectors and shaded magnitude) from (a)ERA5 (b) MMCFSv1 © MMCFSv2, and biases (d) MMCFSv1 – ERA5 (e) MMCFSv2 – ERA5, difference between the model winds (f) MMCFSv2 – MMCFSv1

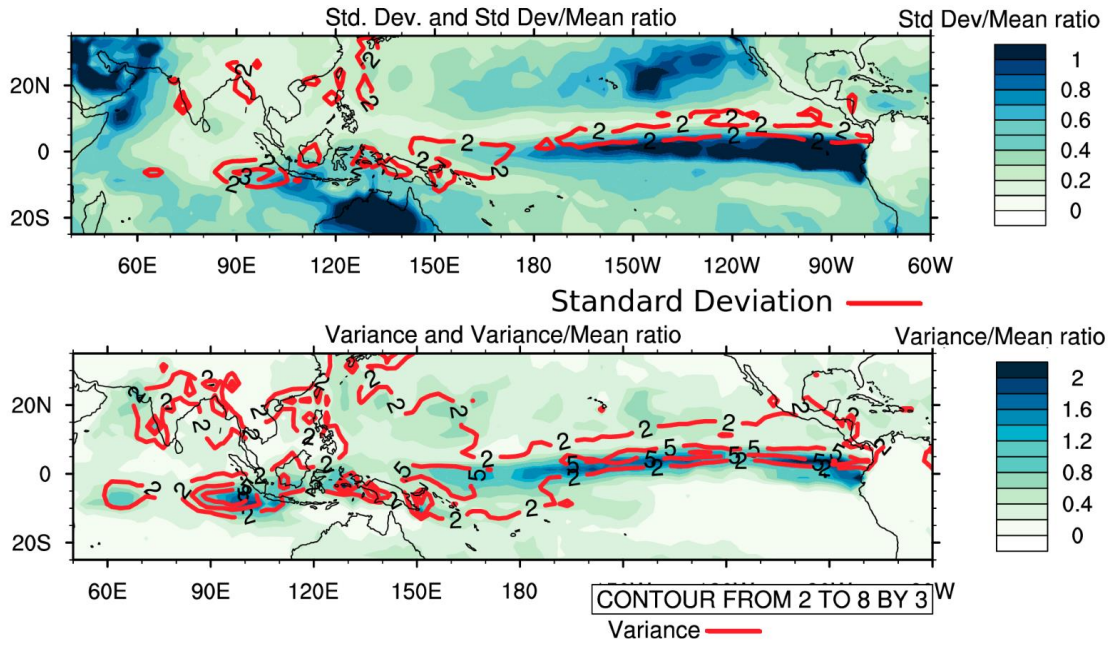

Figure 2a. Top panel - Standard Deviation (red), and ratio of std. Deviation to mean rainfall (color shading) from GPCP (1981-2022). Bottom panel - Variance (red), and ratio of variance to mean rainfall (color shading)

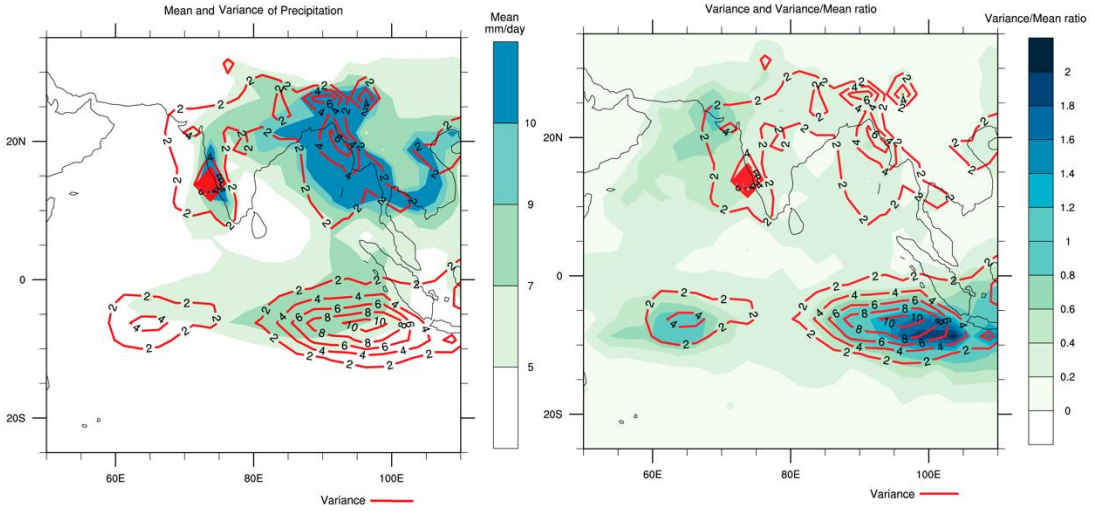

Figure 2b. Left panel - Variance (red), and mean rainfall (color shading) zoomed over Indian region from GPCP (1981-2022). Right panel - Variance (red), and ratio of variance to mean rainfall (color shading)

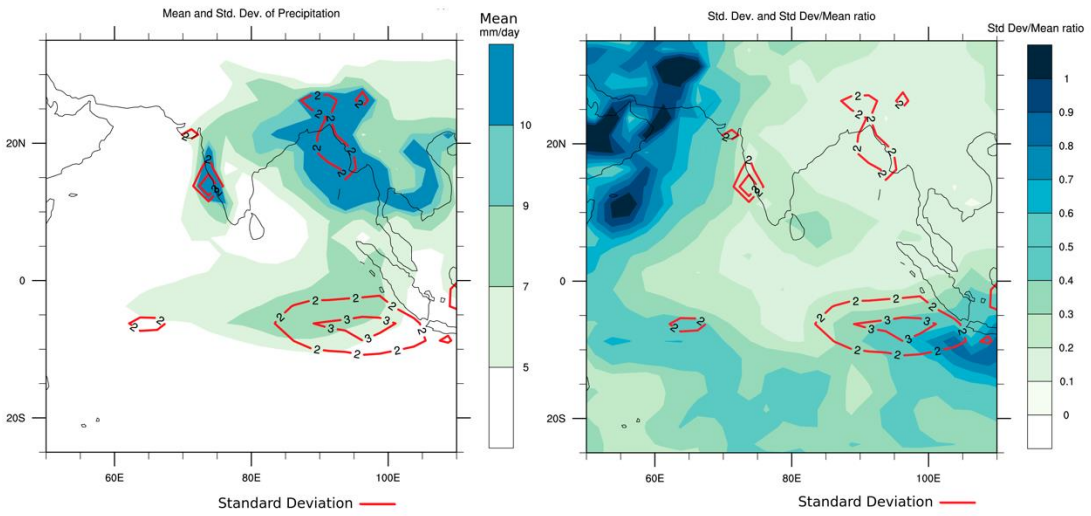

Figure 2c. Left panel – Standard Deviation (red), and mean rainfall (color shading) zoomed over Indian region from GPCP (1981-2022). Right panel - Standard Deviation (red), and ratio of Standard Deviation (red) to mean rainfall (color shading)

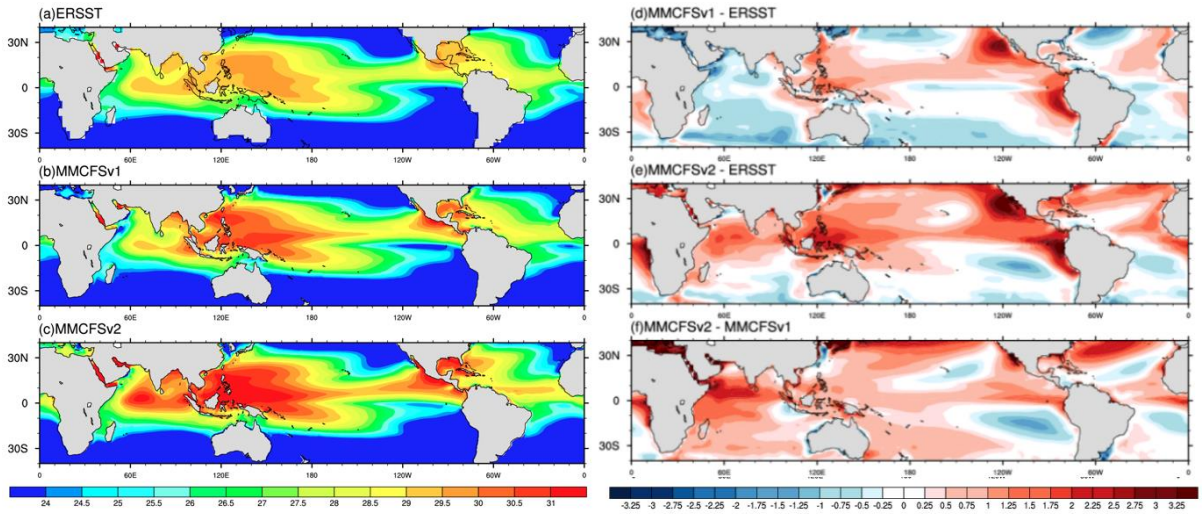

Figure 3. SST from (a) ERSST (b) MMCFSv1 © MMCFSv2 and biases (d) MMCFSv1 – ERSST (e) MMCFSv2 – ERSST, and model difference in SST (f) MMCFSv2 – MMCFSv1 (The contours have been adjusted to highlight 0.25 degree differences as well)

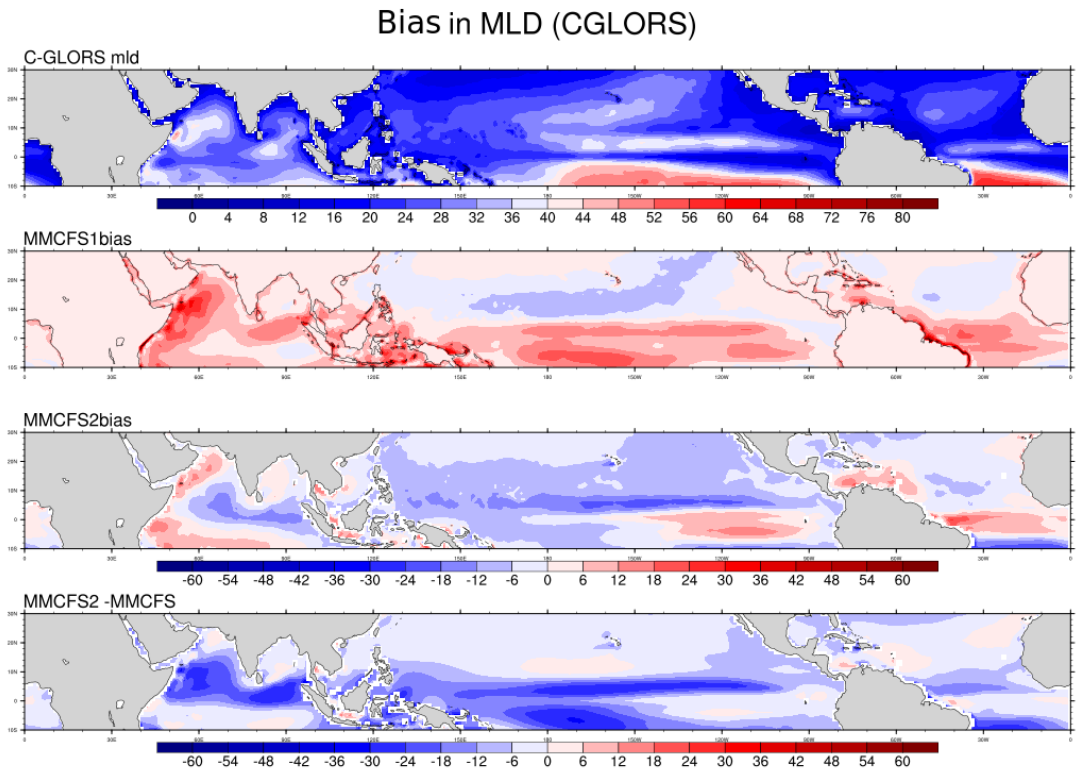

Figure 4a. Top panel is MLD from C-GLORS, mid panels are model bias from CGLORS and bottom panel is the difference between Mixed layer depth from MMCFSv1 and MMCFSv2.

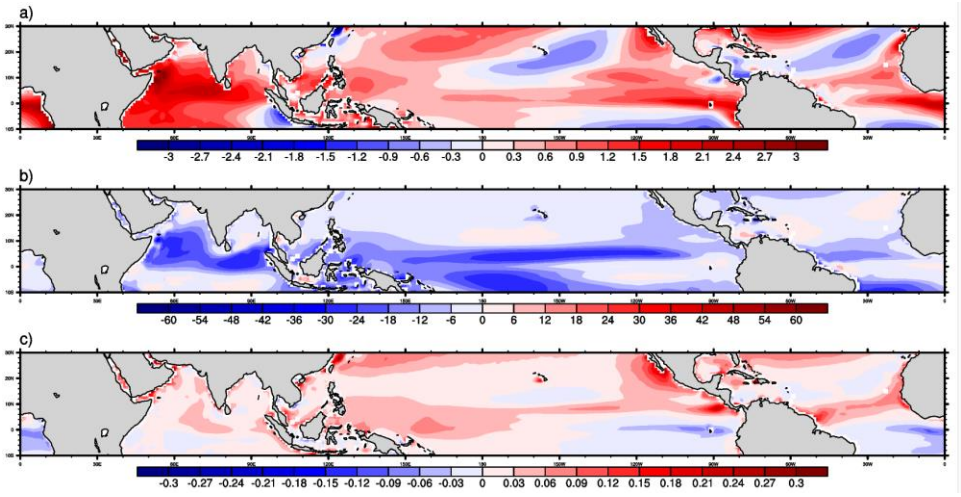

Figure 4b. Heat budget analysis of mixed layer depth from MMCFSv1 and MMCFSv2 showing (a) SST differences between v2 and v1 (V2 - V1) (b) MLD difference (V2 - V1) © Qnet contribution to MLD heating.

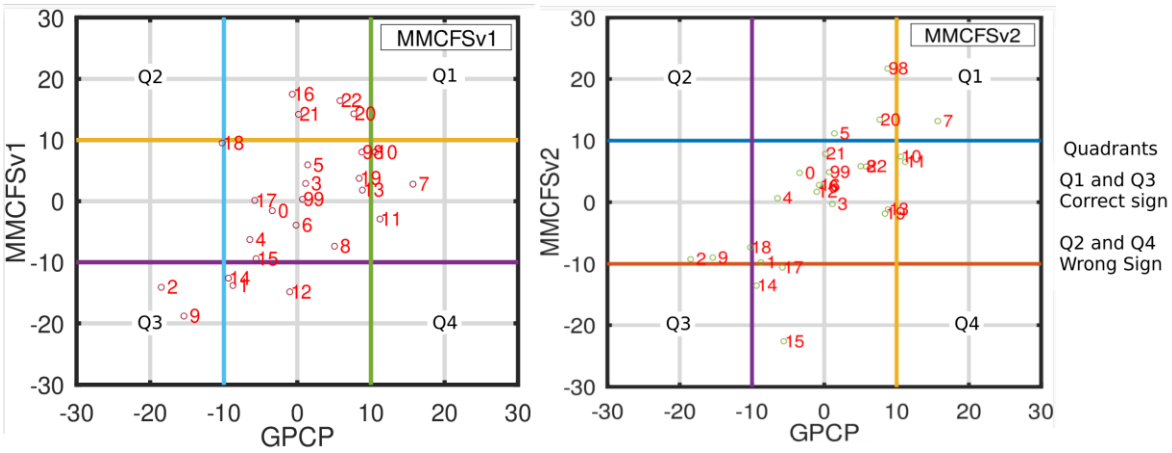

Figure 5a. Scatter plot of ISMR anomaly (percentage) from GPCP (x-axis), and MMCFS (y-axis), left panel is MMCFSv1 and right panel is MMCFSv2.

GPCP	10% departure		GPCP	5% departure	
Normal Years	V1	False Alarm	Normal Years	V1	False Alarm
19		7	8		4
Excess		Hit Rate	Excess		Hit Rate
3		2	9		10
Drought	V2	False Alarm	Drought	V2	False Alarm
3		5	8		2
Total Extreme Years		Hit Rate	Total Extreme Years		Hit Rate
6		2	17		14

Table 5. Table summarizing observed normal, excess, and drought years (first column uses 10% departure from mean, and third column uses 5% departure from the mean to define extreme years). The second (10%) and the fourth column (5%) summarizes hit rates and false alarms from v1 and v2 of MMCFS.

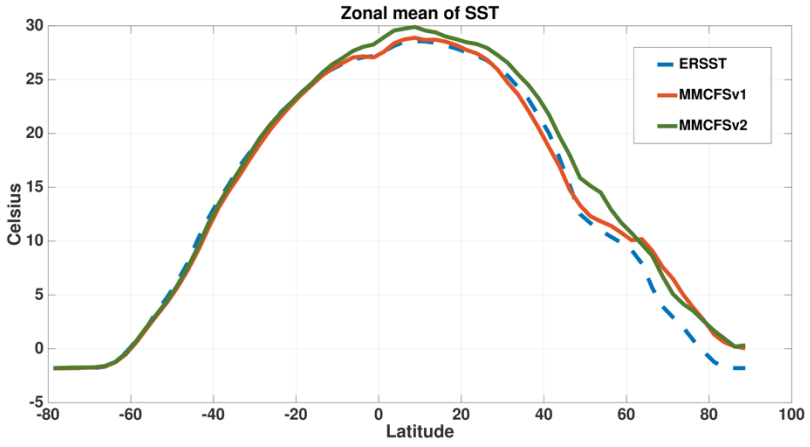

Figure 6a. Global Zonal mean SST from Observation (ERSST) and models (MMCFS v1 and v2)

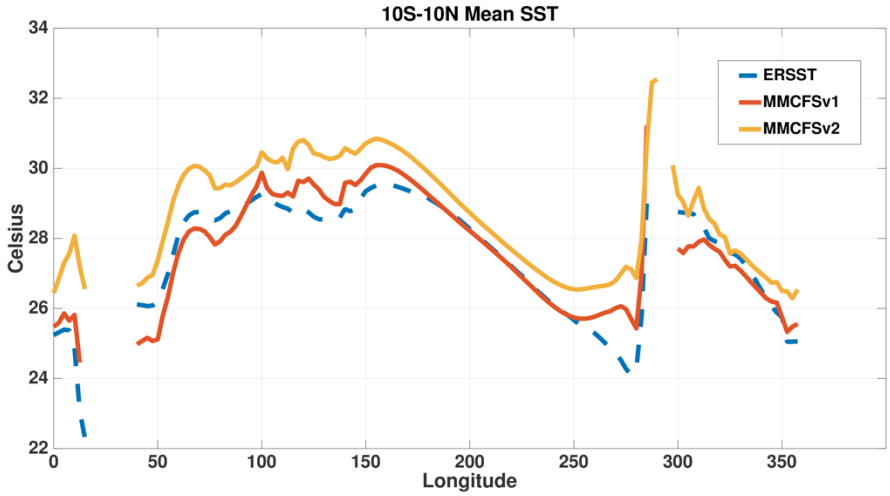

Figure 6b. 10S-10N mean SST from Observation (ERSST) and models (MMCFS v1 and v2)

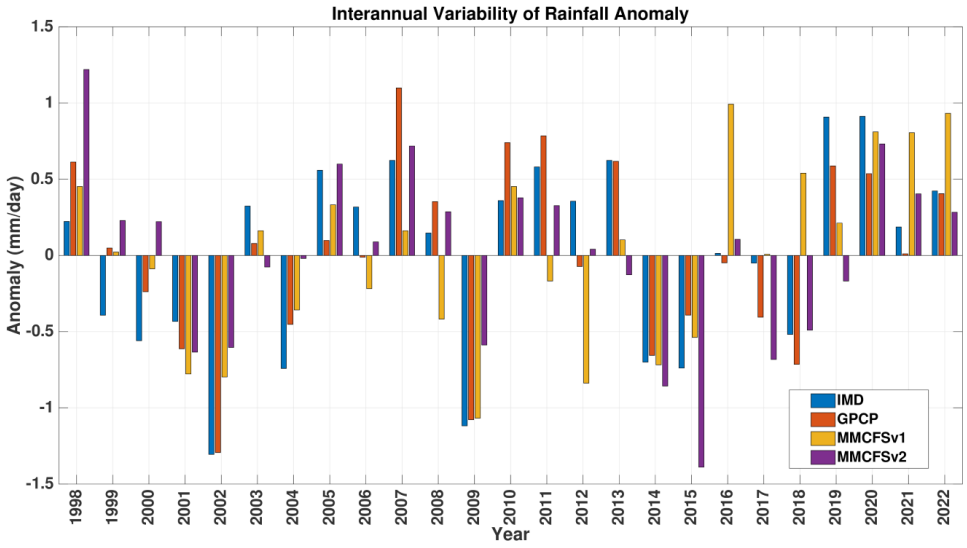

Figure . Interannual variability of ISMR shown using anomalies in mm/day

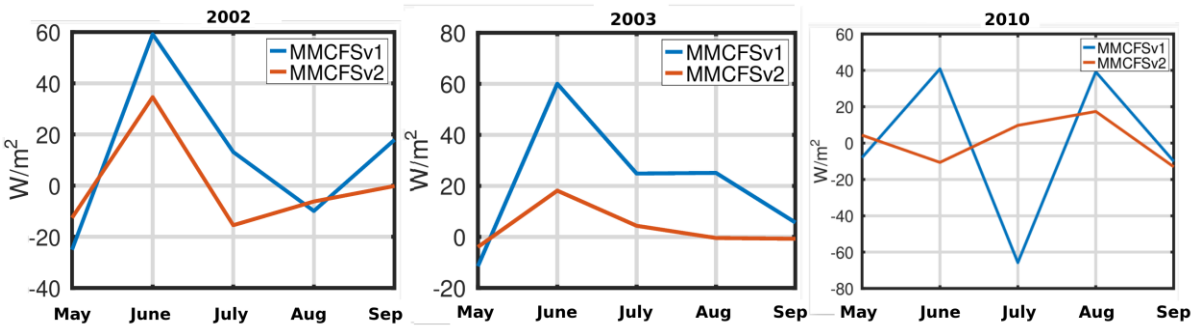

Figure 8 – Monthly time series of difference in latent heat flux (lhf of 21st April initial conditions (00 and 12Z mean) minus lhf of 1st April initial conditions (00 and 12Z mean)) for 2002, 2003, and 2010 over Arabian Sea (8-16N, 54-74E).