Intraseasonal surface salinity variability and the MJO in a climate model

Jieshun Zhu[1,2], Arun Kumar[1], Wanqiu Wang[1]

[1]NOAA/NWS/NCEP/CPC; [2]ESSIC/UMCP;

Background and Motivation:

- Surface and upper ocean salinity are significantly modulated by the MJO, but **inconsistencies** were reported even in a ***qualitative*** respect about the relative role of ocean dynamics vs. E-P (e.g., Matthews et al. 2010; Grunseich et al. 2013; Guan et al. 2014);
- The current **salinity observational** coverage, together with a lack of high-quality 3D **ocean current** observations, is **not sufficient** for a ***quantitative*** description about salinity/freshwater budgets related to the MJO;

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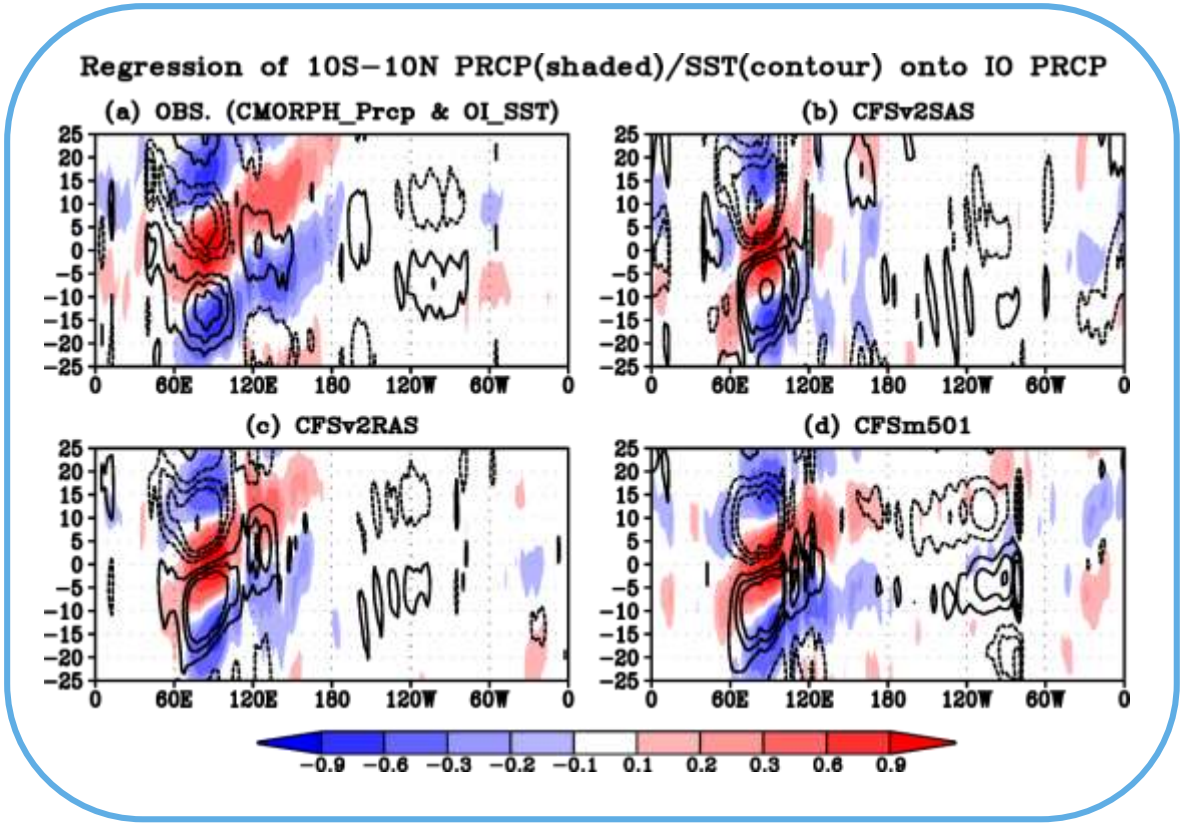
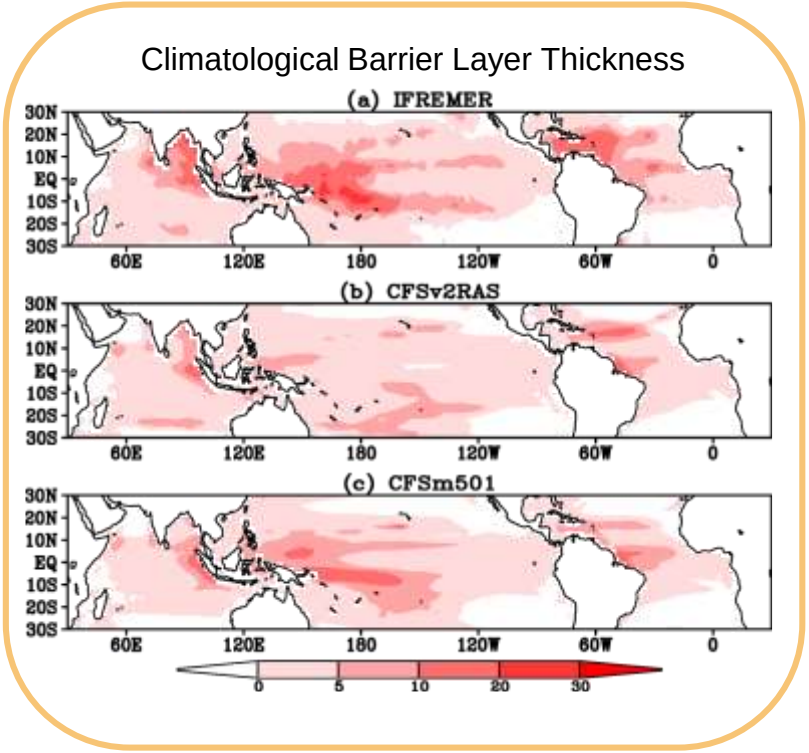
Model: CFSm501

Two major modifications relative to the operational CFSv2:

1) The SAS atmospheric convection scheme=>RAS

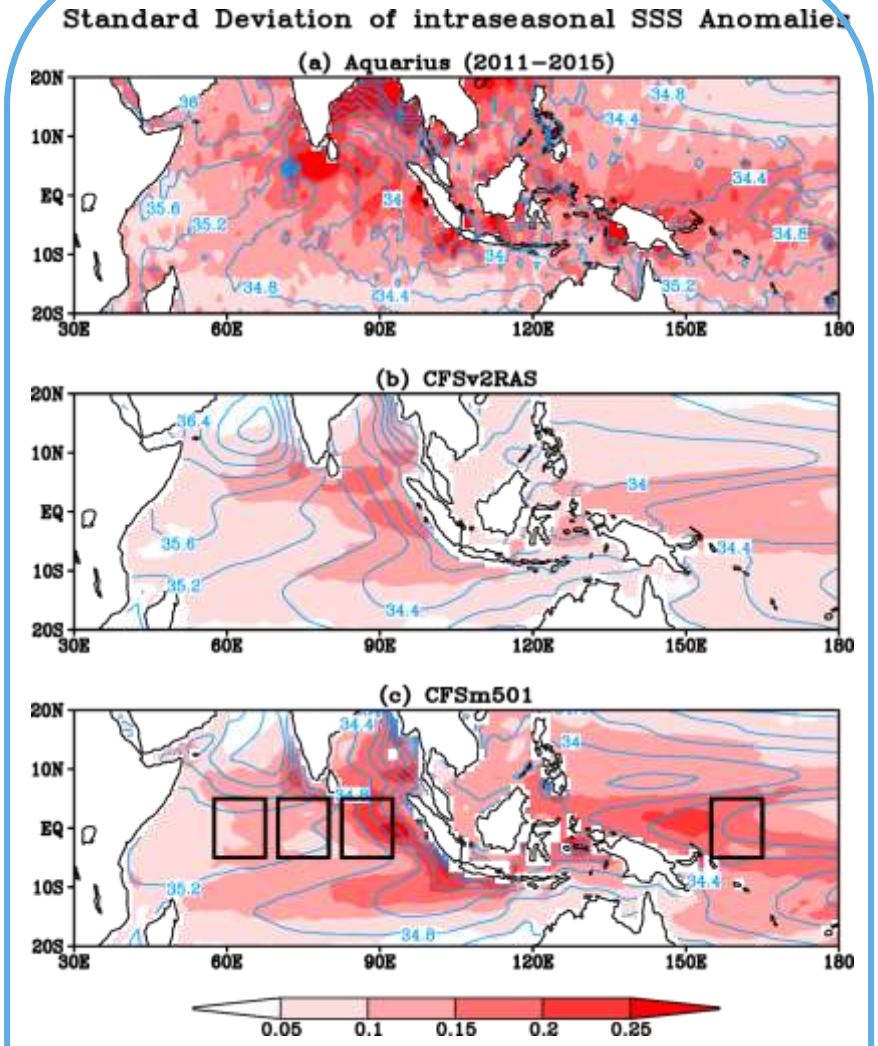
2) Near the ocean surface, 10-meter vertical resolution=>1-meter



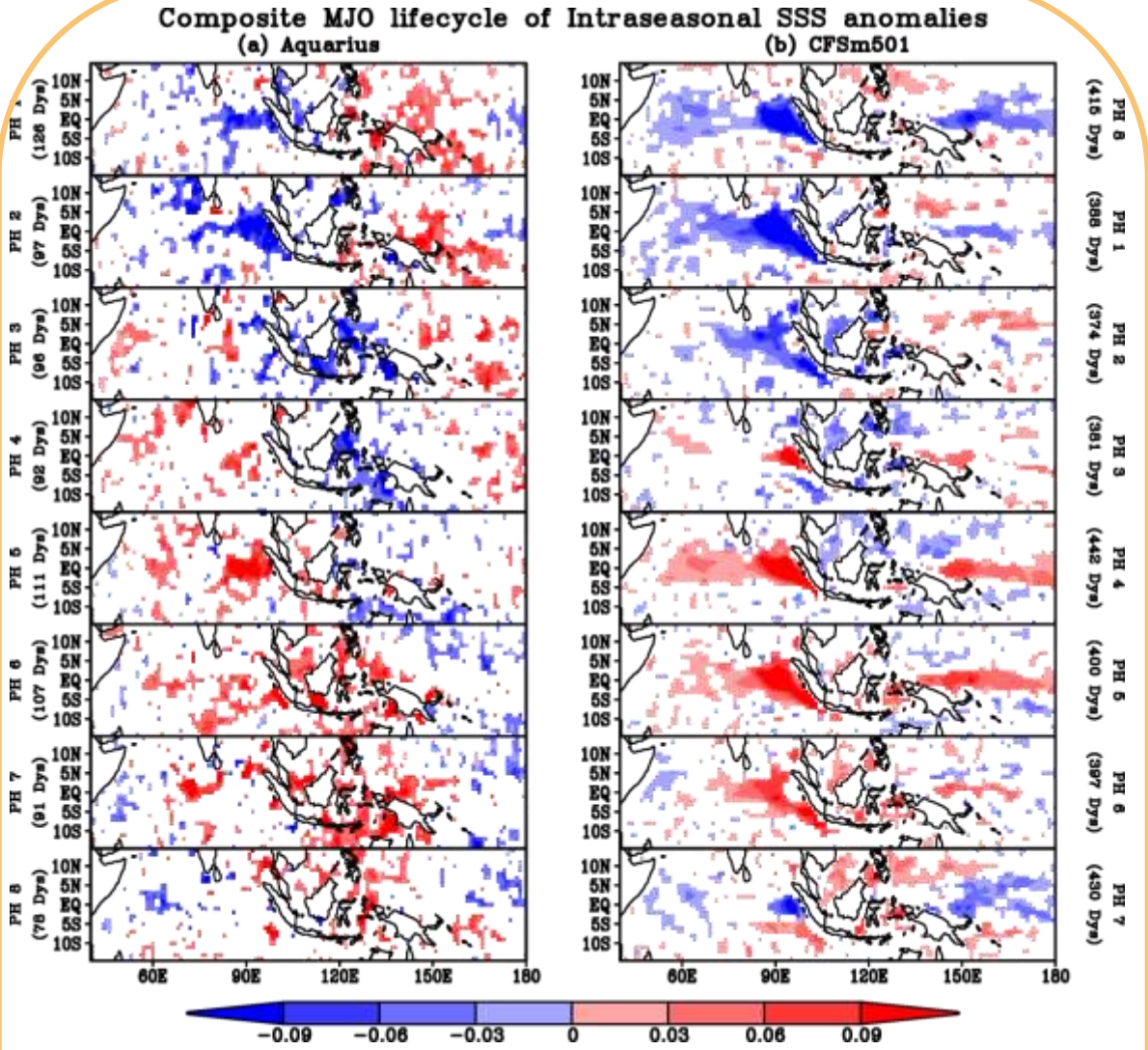


- Improved simulations of the **MJO**, **barrier layer** distribution/thickness, intraseasonal SST/SSS variance……

Simulations of intraseasonal salinity variability



- The adoption of 1-m vertical oceanic resolution significantly improves the simulations of the intraseasonal SSS **variance**.



- CFSm501 realistically captured the composite **MJO lifecycle of intraseasonal SSS** anomalies.

Upper ocean salinity budget analysis

$$\frac{\partial S_a}{\partial t} = \frac{1}{h}S_0(E-P) - v_a \cdot \nabla S_a - \frac{1}{h}\nabla \cdot \int_{-h}^{0} \hat{v}\hat{S}dz - \frac{1}{h}(S_a - S_{-h})\left(\frac{dh}{dt} + w_{-h}\right) - \frac{1}{h}F_{-h}$$

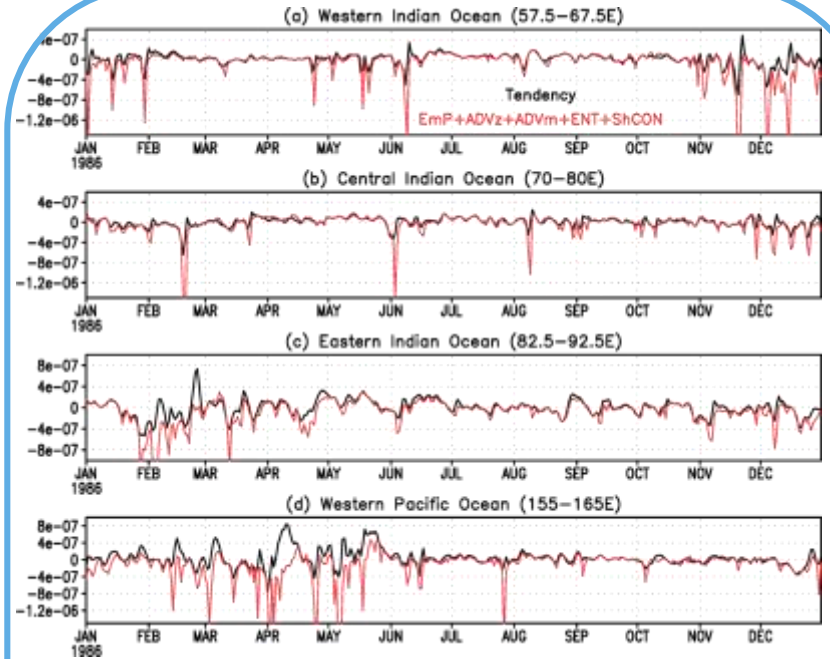
EmP

ADVz & ADVm

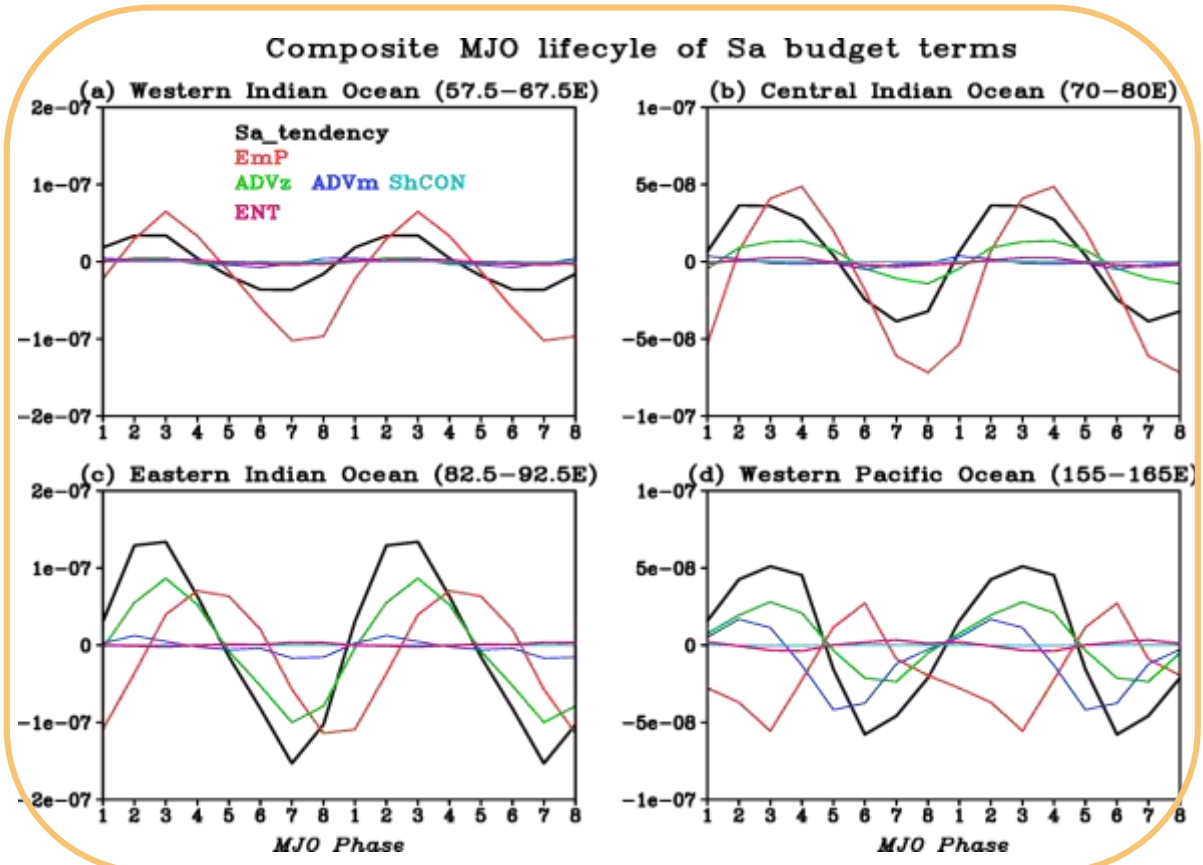
ShCON

ENT

(Cronin and McPhaden 1998)



Except some occasional events/periods, the mixed layer salinity tendency is closed by E-P flux and advection terms.



There is a strong regional dependency about the role of E-P flux vs. ocean dynamics in the intraseasonal SSS anomalies.

Summary

- The usage of the **RAS** convection scheme improves the MJO significantly;
- The adoption of **1-m vertical** oceanic resolution improves the simulations of **climatological BL** distribution/thickness and **intraseasonal SSS**;
- Salinity budget analysis suggests a strong **regional dependency** about the role of **E-P flux vs. ocean dynamics** in the intraseasonal SSS anomalies.

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