Upstream Surface Heat flux Effects on the South China Sea Summer Monsoon

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1. Introduction

Sensitivity experiments of the upstream factors that could affect the South China Sea Summer Monsoon (SCSSM) onset and its subsequent evolution have been carried out using a regional climate model. The upstream regions here refer to the Bay of Bengal (BOB) and the two landmasses, i.e., the Indochina Peninsula (ICP) and the Indian subcontinent (IND). The factors include the sensible heat flux over the two landmasses and sensible heat flux over BOB.

2. Model and experiments design

The model used is the modified regional climate model developed by the National Climate Center of China and the City University of Hong Kong based on the NCAR RegCM2 (Ding et al. 2000; Chan et al. 2004). Three sensitivity experiments have been made here: cutting off only the latent heat flux over the BOB (BOBqfx), cutting off both the BOBqfx and the sensible heat flux over the ICP (BOBqfx+IChfx), and cutting off all the heat flux over the BOB, ICP and IND (BOBqfx+IChfx+INDhfx).

3. Results

Preliminary results show that removing the heat flux over the SCS upstream regions has great effects on the SCS, SC and the western North Pacific, with the effect becoming more significant as the region over which heat flux is cut off increases. A particular result is the prominent decrease of 850hPa westerlies over the SCS during the 3-6 pentads of May, which delays the onset of the SCSSM by 1-2 pentads (Fig.1). For the precipitation in May, a decrease in rainfall is found over the BOB and the adjacent coastal regions, as well as the southern tip of IND, Sri Lanka and parts of East China in BOBqfx (Fig. 2a). In BOBqfx+IChfx, the rainfall decrease region extends further downstream to SCS and South China, and the western North Pacific (Fig. 2b). The largest reduction in rainfall occurs in BOBqfx+IChfx+INDhfx (Fig. 2c). Despite such a quasi-linear relationship, the combined effect is not equal to (actually mostly less than) the sum of the individual effects, which suggests nonlinear interactions.

4. Concluding remarks

The results demonstrate the great of upstream heat flux and SST on the SCSSM. But only one simulation case has been made in our study without ensemble. And a coupled RCM with an ocean model may be necessary for better model performance.

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References

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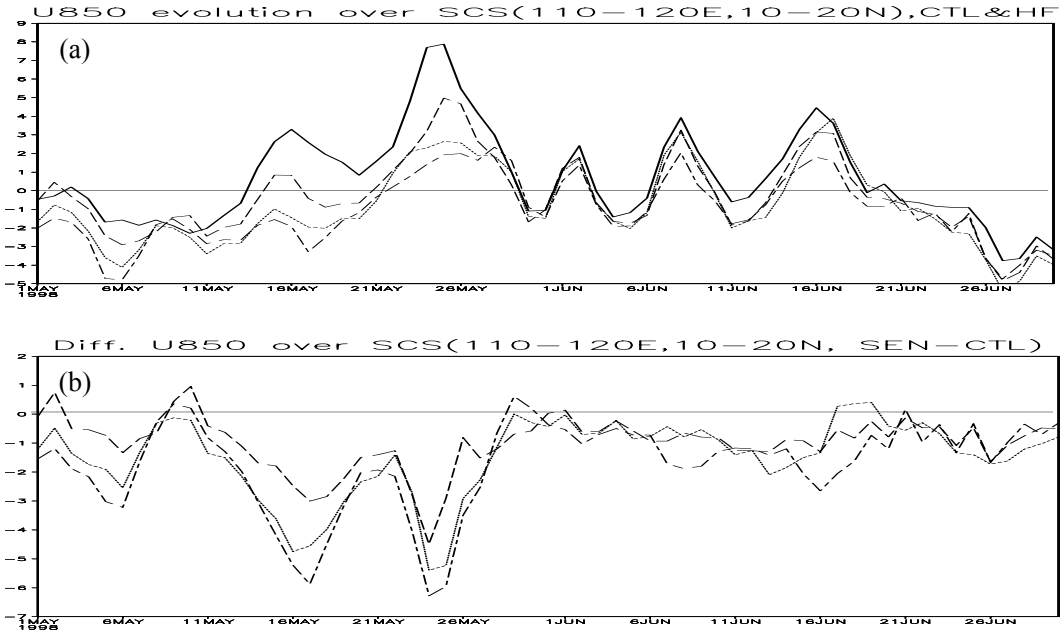

Fig.1 Time evolution of (a) 850 hPa zonal winds and (b) differences in 850-hPa zonal wind between the sensitivity experiments and the control experiment (CTL). All values are averaged over the region (10-20ºN, 110-120ºE). Unit: m s^{-1}. Solid line in (a): CTL, Long dashed line: BOBqfx, Dotted line: BOBqfx+IChfx, Long dashed, short dashed line: BOBqfx+IChfx+INDhfx.

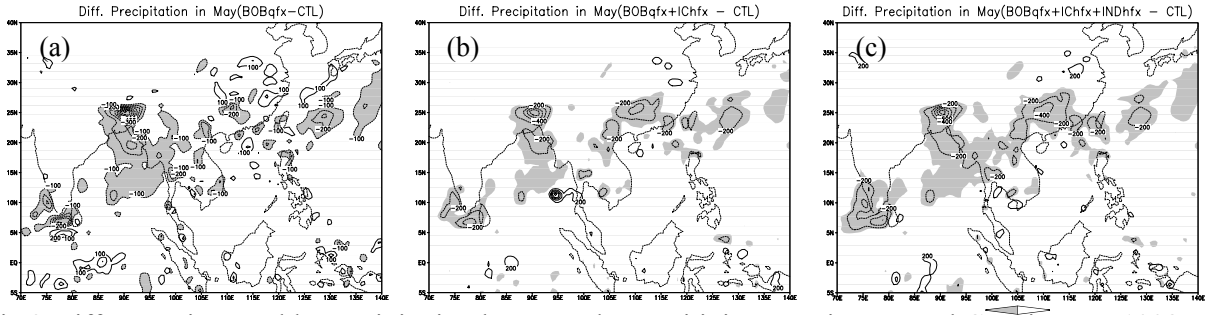

Fig.2 Difference in monthly precipitation between the sensitivity experiments and CTL in May 1998. (a) BOBqfx, (b) BOBqfx+IChfx, and (c) BOBqfx+IChfx+INDhfx. Unit: mm. Differences ≤ –100 mm are shaded.