Does the Tibetan Plateau influence the upwelling system of the Arabian Sea and Bay of Bengal?

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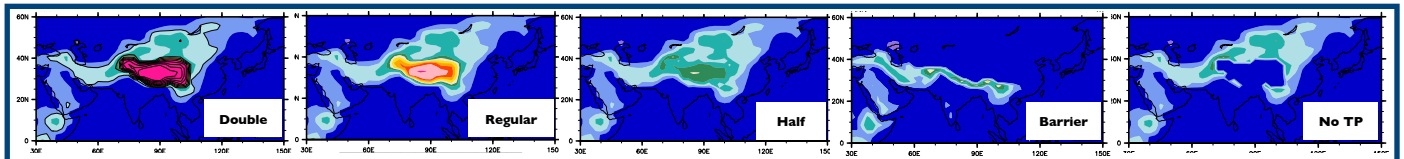
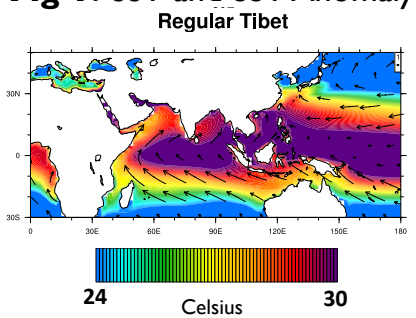
Abstract: We explore in a model framework how topography over Central Asia affect the the availability of favorable winds for upwelling regimes in the Arabian Sea and Bay of Bengal. We show that these nutrient rich zones are directly linked to the existence of the Tibetan Plateau (TP) such that during JJA summer months increased surface winds, Ekman pumping, and cooler sea surface temperature over the Arabian Sea becomes greater when TP is incrementally increased.

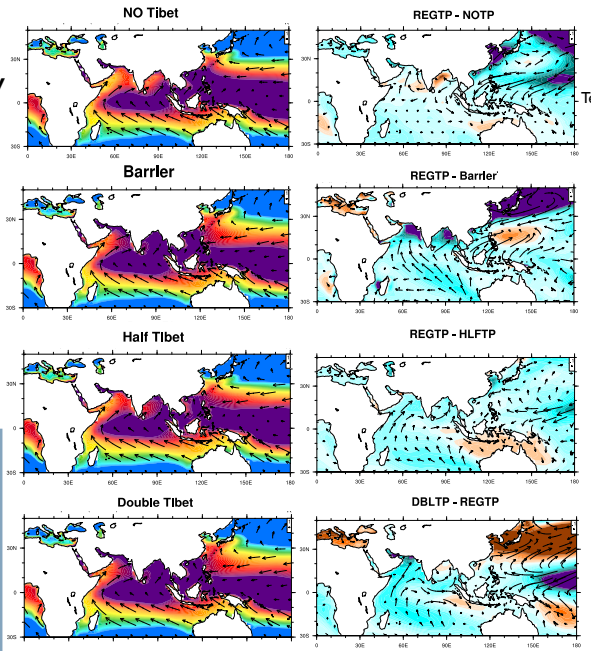


Methods: The primary model used for this project was CESM version 1.05 with CAM4 AGCM (Zang and McFarlane 1995). We utilized slab ocean and fully coupled models, and used modern boundary conditions to initiate our equilibrium simulations. A total of five topography configurations were used (see above) similar to Kutzbach et al., (1998). Each simulation ran more than a hundred years and the last twenty years were used as our monthly climatology files.

Slab Ocean

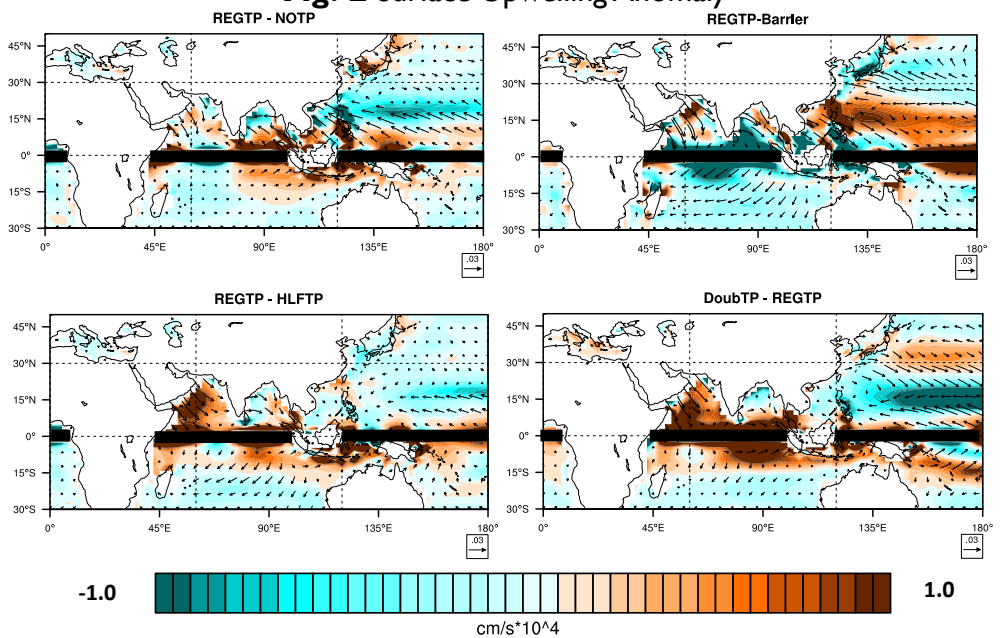
Fig 1. SST and SST Anomaly





Figures: (1) Sea surface temperature of all configurations and respective anomaly plots. Vectors represents surface wind strength and direction(m/s). (2) Calculated Ekman pump (EP) (cm/s*10^4) using Chereskin and Price (2001). Vectors represent directional movement of surface water and black bars are areas where calculated EP are ineffective. Figures 1 & 2 are slab ocean configuration. (3) Fully coupled anomaly plots of double and regular topography. Same caption as figure 1 and 2.

Fig. 2 Surface Upwelling Anomaly



Citation

1. Chereskin T. K., Price J.F. 2001: Ekman transport and pumping. Academic Press 809-815.

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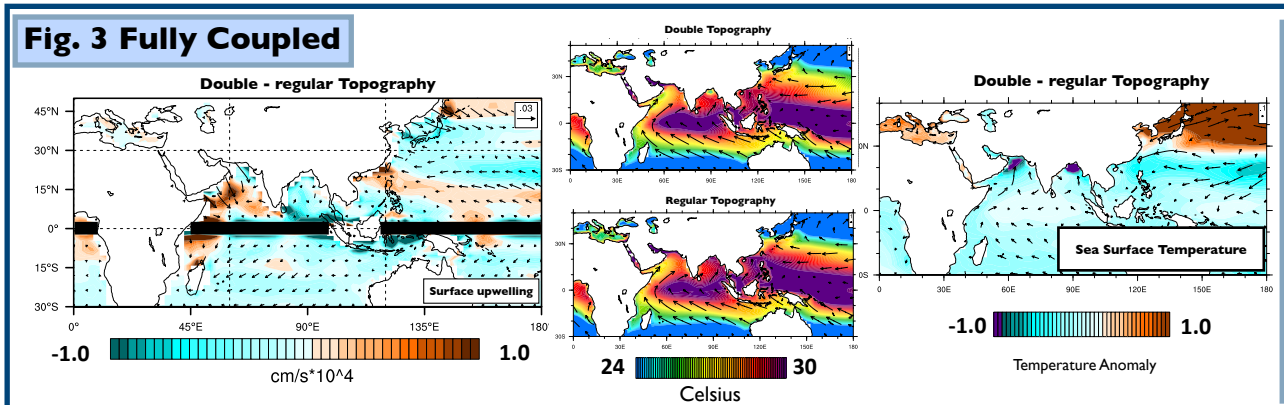
Fig. 3 Fully Coupled



Key Points

- JJA SST in general decrease over the Arabian Sea as you increase topography.
- Surface wind stress is greater with higher TP over Arabian Sea and Bay of Bengal.
- Ekman pumping over both regions becomes greater as you increase topography.
- Our fully coupled simulations have nearly identical results as our slab ocean simulation, indicating the robust nature of our work