

Land-surface Impacts on the Asian monsoon circulation using AGCM large-ensemble

By H.G. Takahashi, S. Sugimoto, T. Sato

Introduction

- Land-surface conditions, like SAT & snow cover, over the TP controls the strength of the Asian monsoons.
 - (Hahn and Shukla 1976; Vernekar et al. 1995; Yasunari et al. 1991; Shaman and Tziperman 2005).
 - A weaker SAT gradient in the north-south direction weakens monsoon circulation, resulting in less monsoon precipitation.
 - (Goswami and Xavier 2005).
- Because of significant SST impacts (e.g., El Nino), land - surface impacts are mostly hidden or suppressed.
- This study isolates the impacts of land - surface conditions and tries to quantify them.
 - Using AGCM large -ensemble datasets (d4PDF; Mizuta et al. 2016, BAMS)

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Impact of spring land -surface conditions over and around the Tibetan Plateau on the early summer Asian monsoon circulation using AGCM large-ensemble

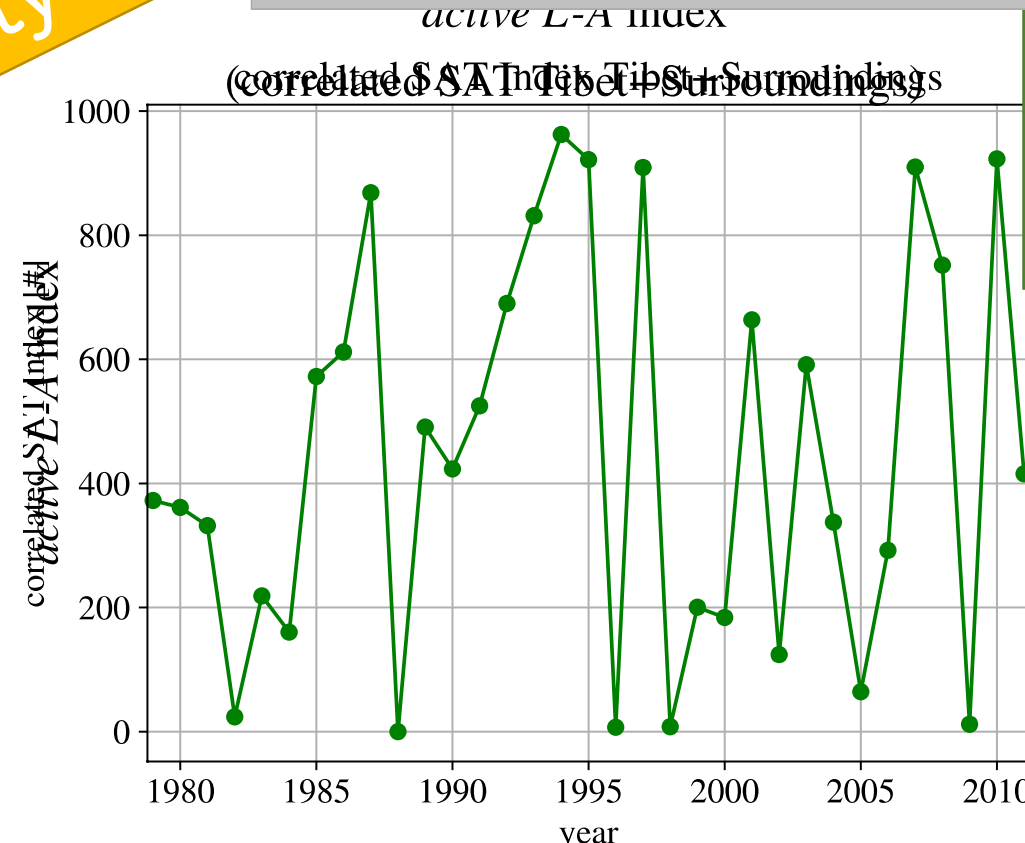
Land-Atmosphere (L-A)

AGCM-LE: 100-AGCM exps. under the same SST conditions (100 times AMIP)

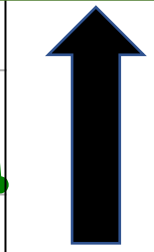
Land-Atmos-Ocean climate variability



Land-Atmosphere climate variability



active L-A year

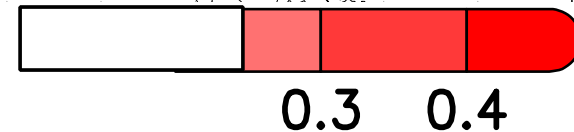
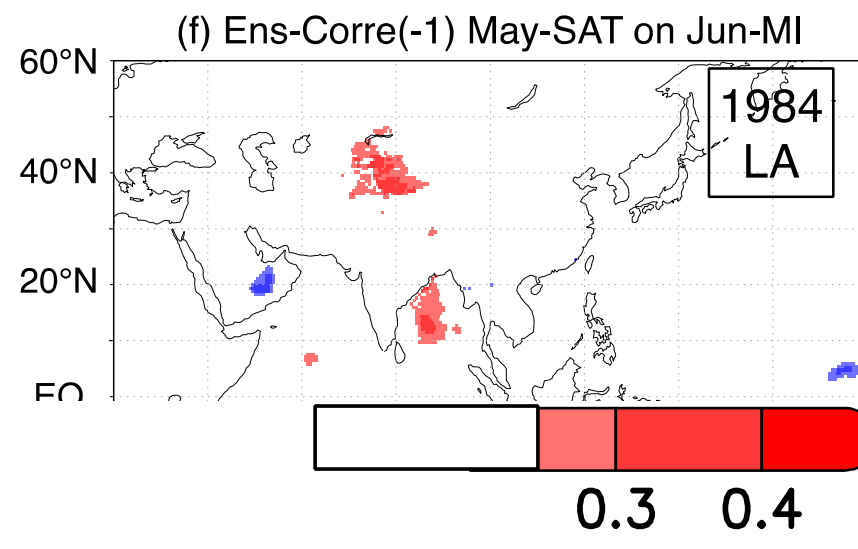
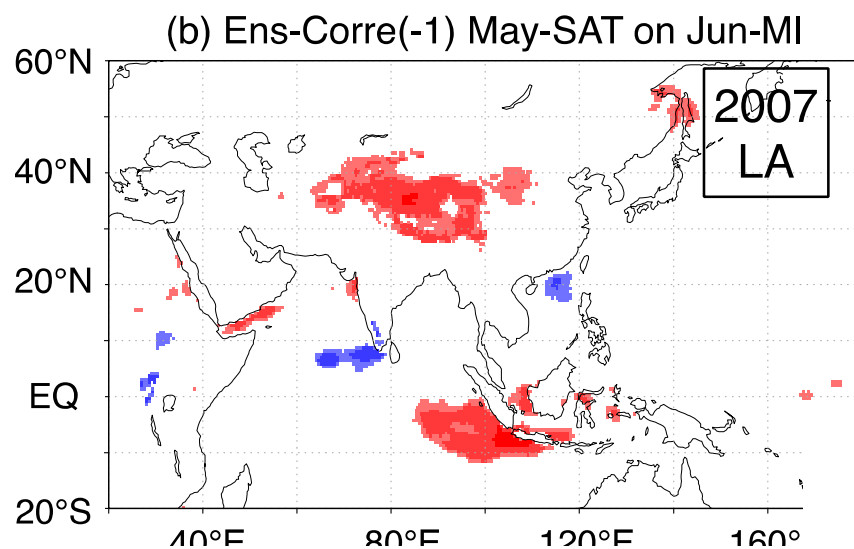
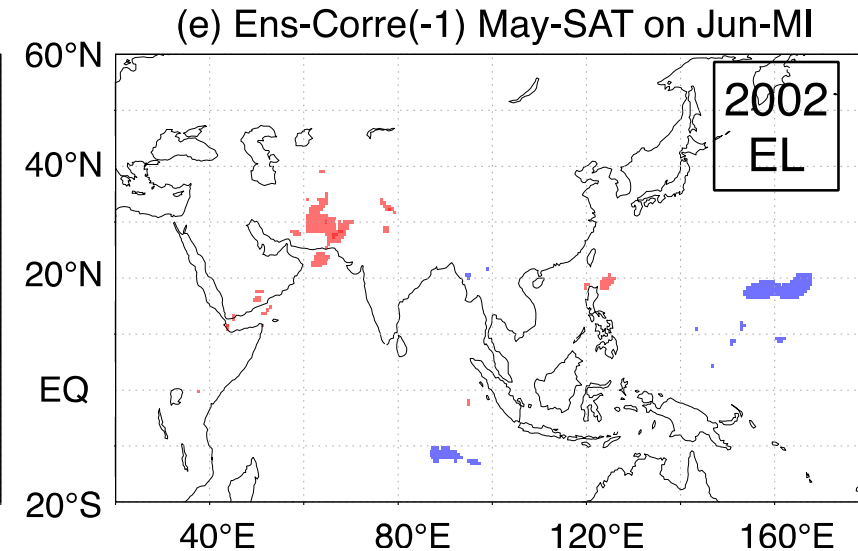
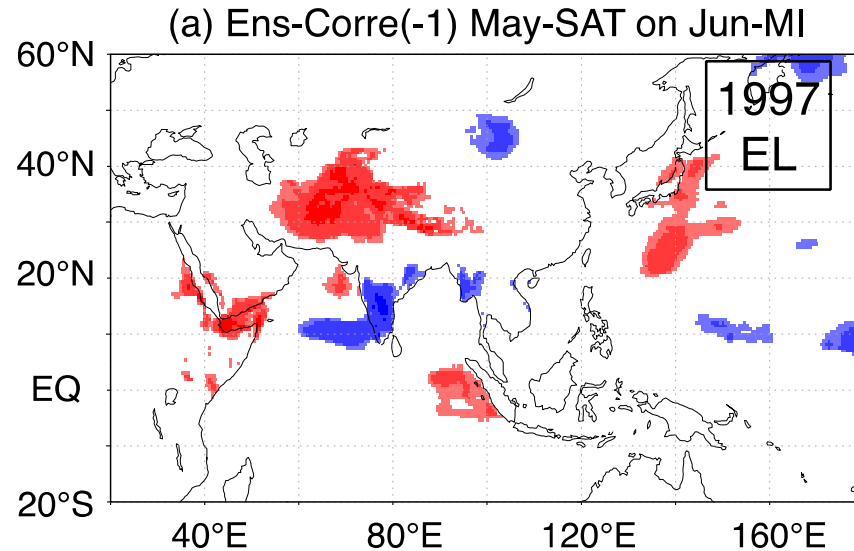


Inactive L-A Year = strong SST forcing

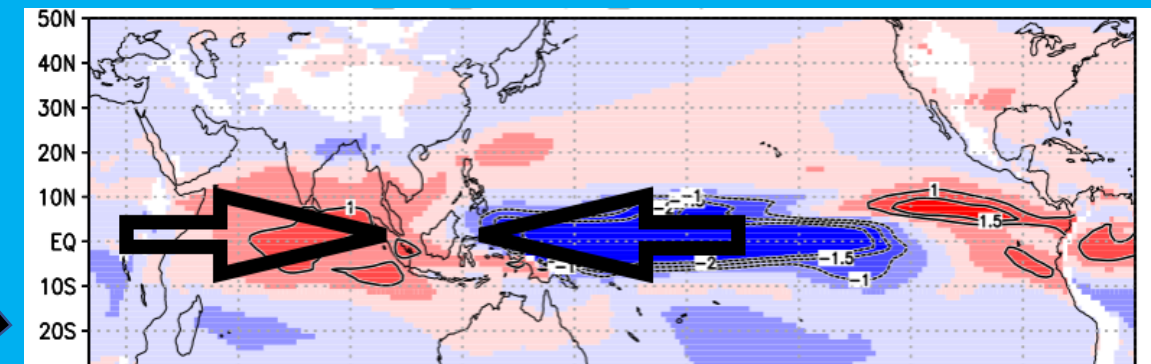
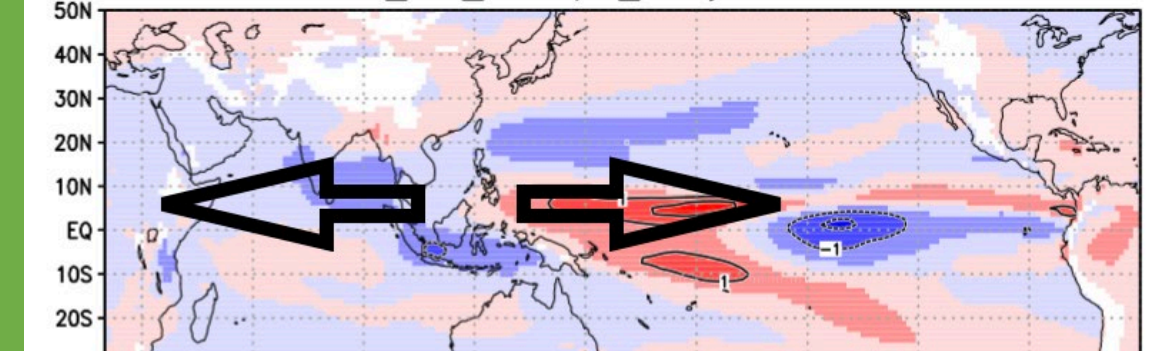
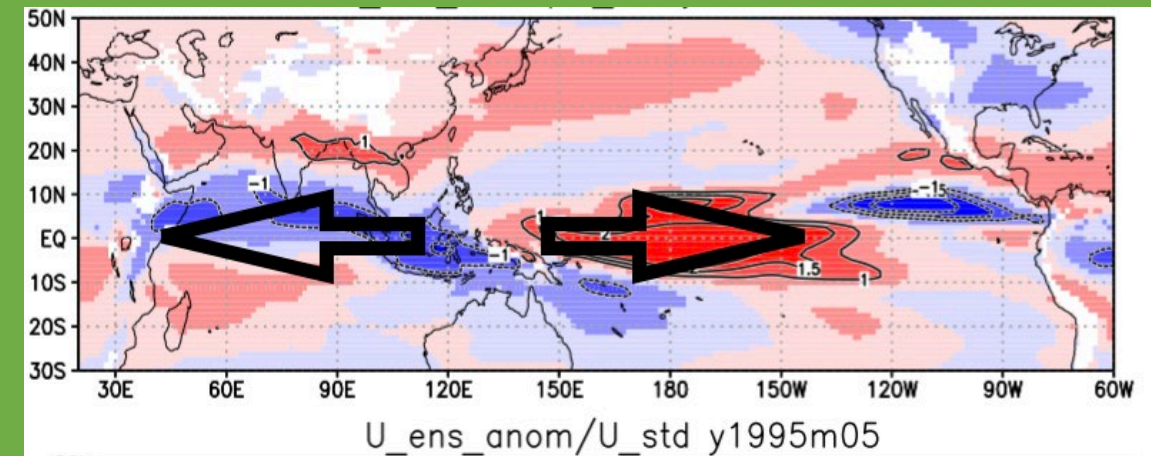
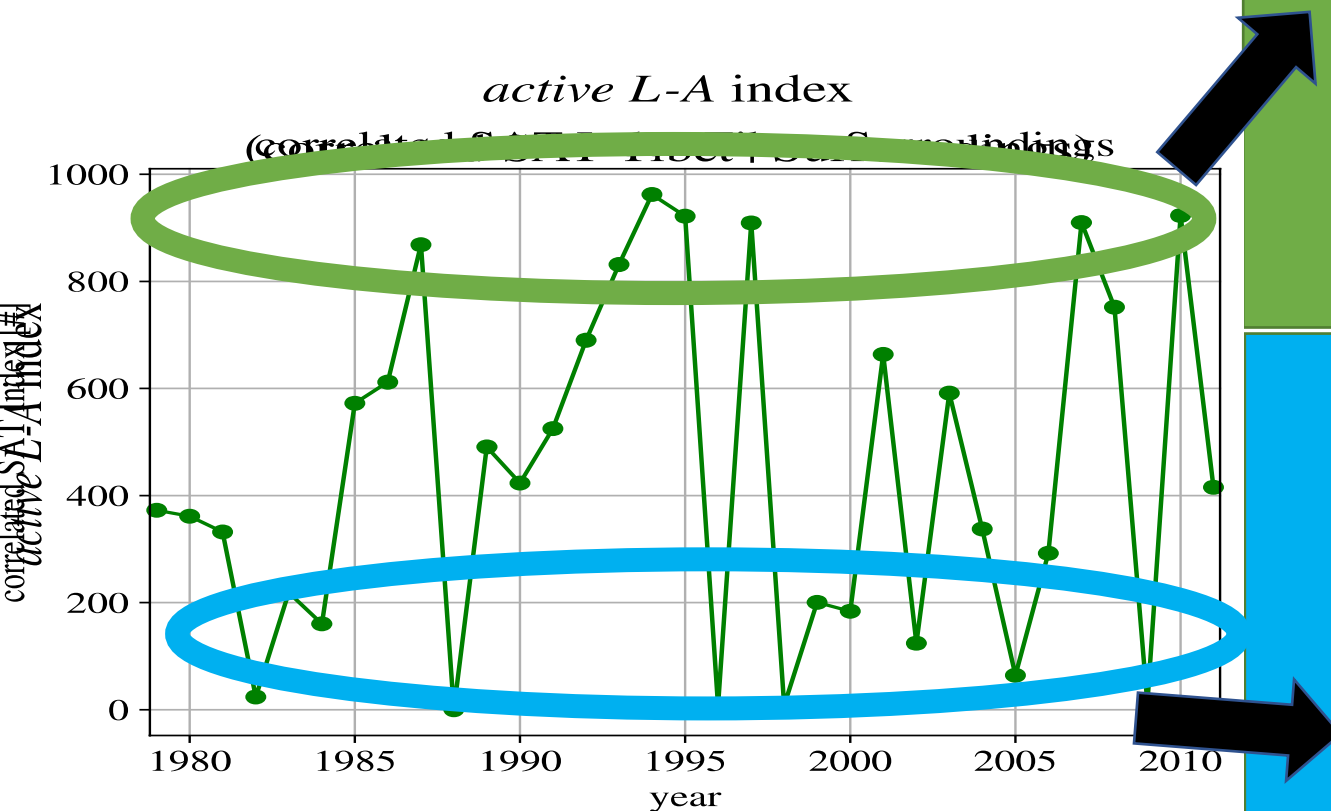
Lag-correlations between SAT and monsoon circulation

Red: May Warm SAT => June Strong Monsoon

- TP surface conditions sometimes control monsoon circulation, but sometimes not.
- The TP surface effects vary interannually.
 - Our analysis (d4PDF model): LS4P years
 - 2003: strong
 - 1998: very weak



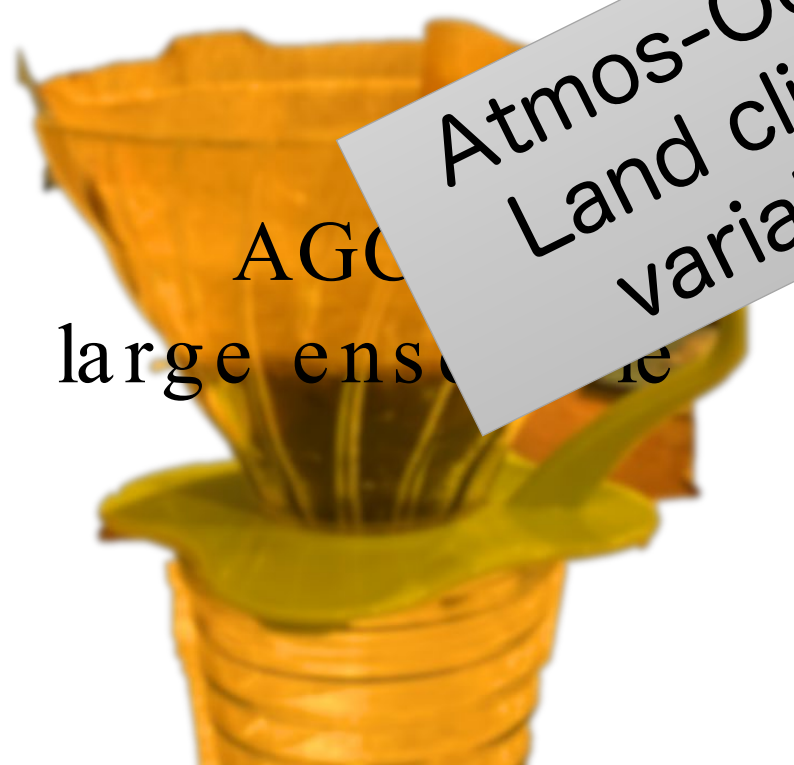
- ENSO cannot explain the interannual variation of L-A interaction strength (evenly included in each categories).
- Controlling by background conditions (Strong SST forcing may suppress L-A coupling.)
- Convective activity over Maritime Continent may suppress L-A coupling over the Asian monsoon region.



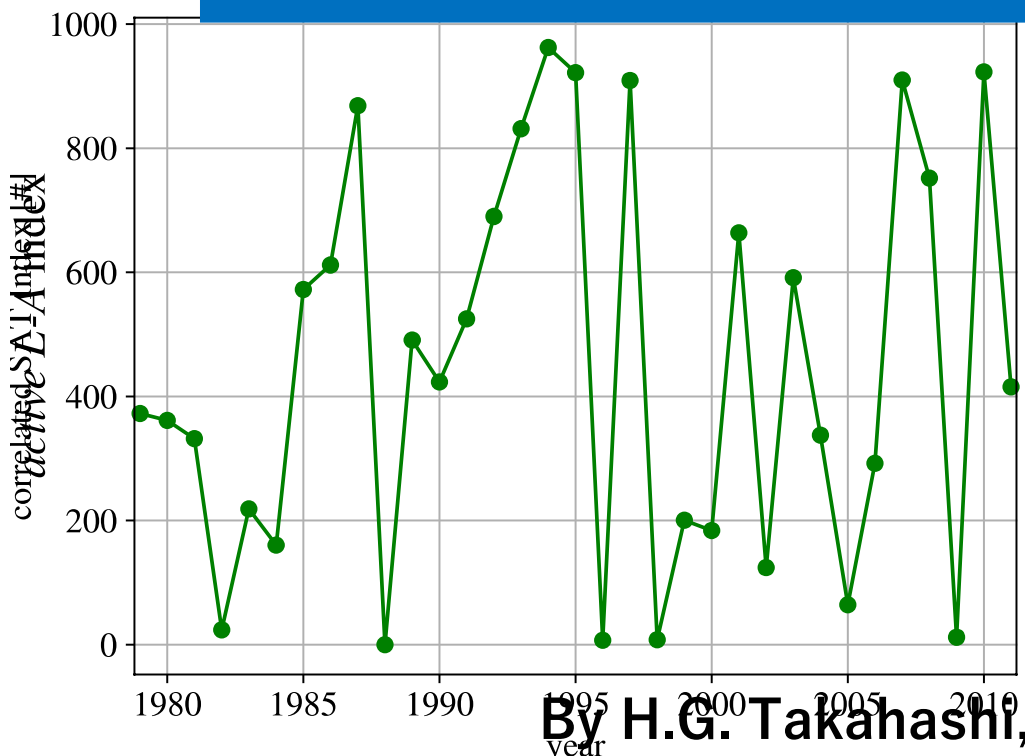
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Atmos-Ocean-Land climate variability

NOTE: land-surface impact can be difference among background SST conditions. I feel it is better to select a good L-A year for multi-model experiments.



Land-Atmosphere climate variability



active L-A year