Uncertainty in the projections of ENSO amplitude change under global warming: Role of the response of atmospheric circulation to SST anomalies

*Jun Ying[1]

1. Second institute of Oceanography, Ministry of Natural Resources

The study investigates the mechanism of the large inter-model uncertainty in the change of ENSO’s amplitude under global warming, based on 31 CMIP5 models. We find that the uncertainty in ENSO’s amplitude is significantly correlated to that of the change in the response of atmospheric circulation to SST anomalies (SSTAs) in the eastern equatorial Pacific Niño3 region. This effect of the atmospheric response to SSTAs mainly influences the uncertainty in ENSO’s amplitude during El Niño (EN) phases, but not during La Niña (LN) phases, showing pronounced nonlinearity. The effect of the relative SST warming and the present-day response of atmospheric circulation to SSTAs are the two major contributors to the inter-model spread of the change in the atmospheric response to SSTAs, of which the latter is more important. On the one hand, models with a stronger (weaker) mean-state SST warming in the eastern equatorial Pacific, relative to the tropical-mean warming, favor a larger (smaller) increase in the change in the response of atmospheric circulation to SSTAs in the eastern equatorial Pacific during EN. On the other hand, models with a weaker (stronger) present-day response of atmospheric circulation to SSTAs during EN tend to exhibit a larger (smaller) increase in the change under global warming. The result implies that an improved simulation of the present-day response of atmospheric circulation to SSTAs will be effective in lowering the uncertainty in ENSO’s amplitude change under global warming.

Keywords: ENSO amplitude , Global warming, Uncertainty, relative SST warming