EGU2020-19900
https://doi.org/10.5194/egusphere-egu2020-19900
EGU General Assembly 2020

Emergence of the projected trends in the tropical oceans from background climate noise in CMIP5 simulations

Gopika Suresh[1], Iyyappan Suresh[1], Takeshi Izumo[2], Jerome Vialard[2], and Matthieu Lengaigne[2]
[1]National Institute of Oceanography, Physical Oceanography Department, India (gopikasurvay@gmail.com)
[2]LOCEAN/IPSL, Sorbonne Universités (UPMC, Univ Paris06)-CNRS-IRD-MNHN, Paris, France

Anthropogenic forcing induces a Sea Surface Temperature (SST) warming and sea level rise. While these globally-averaged signals are clearly detectable, it is more difficult to detect regional deviations from these global trends, due to the strong aliasing by internal climate variability. Yet, changes in SST gradients are thought to influence the frequency of extreme IOD events and the impacts of extreme ENSO events, while regional sea level and rainfall changes have strong societal implications. Here, we investigate if such regional signals are already detectable in the tropics.

To that end, we apply the "emergence time" concept (i.e. when the climate change signal irreversibly emerges from the background climate "noise") on historical simulations combined with RCP8.5 projections from the Coupled Model Intercomparison Project (CMIP5). By 2100, CMIP5 projections indicate a warming in relative SST (RSST), i.e. the SST change relative to its tropical mean, in the equatorial Atlantic, equatorial Pacific and Arabian Sea, and a RSST cooling (i.e. weaker warming than the tropical average) in the three subtropical gyres of the southern hemisphere. These models also project positive signals in relative Sea Level Anomalies (RSLA) in the Arabian Sea, 10°N-20°N band in the Pacific, and Benguela upwelling, and negative ones in the central Pacific, south-eastern Pacific and Indian Oceans. Rainfall increases over the equatorial Pacific and India, and decreases over Central America, the southern tropical Pacific and Atlantic. We define a regional trend as detectable when it emerges in more than 80% of the models in the CMIP5 database. With this choice, none of the RSST, RSLA and precipitation signals mentioned above are currently detectable in CMIP5. In the coming decade, the RSST warming in the Arabian Sea, cooling in the southeastern Pacific Ocean and rainfall reduction over central America become detectable, according to CMIP5. The equatorial Atlantic relative warming, Arabian Sea RSLA rise and equatorial Pacific precipitation increase would emerge before 2050. The equatorial Pacific RSST warming, southeastern Indian Ocean RSST cooling, and monsoon rainfall increase over India also become detectable before 2100. Our estimates of the emergence time could help planning a targeted observational strategy in regions, where CMIP5 indicate strong trends, and thus to verify CMIP5 projections in those regions.