**Japan Geoscience Union Meeting 2011**
(May 22-27 2011 at Makuhari, Chiba, Japan)
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ACG004-03 Room:104 Time:May 26 17:00-17:15

# Impact of Global Ocean Surface Warming on Seasonal-to-Interannual Climate Prediction

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Surface air temperature (SAT) over the globe, particularly Northern Hemisphere continents, has rapidly risen over the last 2-3 decades, leading to an abrupt shift toward a warmer climate state after 1997/98. Whether the terrestrial warming might be caused by local response to increasing greenhouse gas (GHG) concentrations or by sea surface temperature (SST) rise is recently in dispute. The SST warming itself may be driven by both the increasing GHGs forcing and slowly-varying natural processes. Besides, whether the recent global warming might affect seasonal-to-interannual climate predictability is an important issue to be explored. Based on the JAMSTEC climate prediction system in which only observed SSTs are assimilated for coupled model initialization, the present study shows that the historical SST rise plays a key role in driving the intensified terrestrial warming over the globe. The SST warming trend, while is negligible for short-lead predictions, has substantial impact on the climate predictability at long-lead times (>1 year) particularly in the extratropics. The tropical climate predictability, however, is little influenced by global warming. Given a perfect warming trend and/or a perfect model, global SAT and precipitation could be predicted beyond 2 years in advance with anomaly correlation skill of above ˜0.6.

Without assimilating ocean subsurface observations, model initial conditions show a strong spurious cooling drift of subsurface temperature; this is caused by large negative surface heat flux damping arisen from the SST-nudging initialization. The spurious subsurface cooling drift acts to weaken the initial SST warming trend during model forecasts, leading to even negative trends of global SAT and precipitation at long-lead times and hence deteriorating the global climate predictability. Concerning the important influence of the subsurface temperature on the global SAT trend, future efforts are required to develop a good scheme for assimilating subsurface information particularly in the extratropical oceans.

Keywords: Global warming, sea surface warming, seasona-to-interannual climate prediction, climate model