EGU2020-6318
https://doi.org/10.5194/egusphere-egu2020-6318
EGU General Assembly 2020

Upper ocean heat content (OHC) changes in the tropical Pacific induced by orbital insolation and greenhouse gases (GHG)

Yue Wang[1], Zhimin Jian[1], Haowen Dang[1], Zhongfang Liu[1], Haiyan Jin[1], Shuai Zhang[2], Li Luo[2], and Xingxing Wang[1]

[1]Tongji University, State Key Laboratory of Marine Geology, Shanghai, China (163wangyue@163.com)
[2]Hohai University, Nanjing, China

The ocean is the largest heat capacitor of the earth climate system and a main source of atmospheric moist static energy. Especially, upper ocean heat content changes in the tropics can be taken as the heat engine of global climate. Here we provide an orbital scale perspective on changes in OHC obtained from a transient simulation of the Community Earth System Model under orbital insolation and GHG forcings. Considering the vertical stratification of the upper ocean, we calculate OHC for the mixed layer and the upper thermocline layer according to the isotherm depths of 26□ and 20□ respectively. Generally, our simulated OHC are dominated by thickness changes rather than temperature changes of each layer. In details, there are three situations according to different forcings:

(1) Higher GHG induces positive mixed layer OHC anomalies inside the western Pacific warm pool but with neglected anomalies outside it. For the upper thermocline layer, there are negative OHC anomalies inside the warm pool and positive anomalies in the subtropical Pacific of two hemispheres. For the total OHC above 20□ isotherm depth, positive anomalies mainly come from the mixed layer between 15ºS-15ºN and from the thermocline between 15º-30º. Lower obliquity induces similar spatial patterns of OHC anomalies as those of higher GHG, but total OHC anomalies are more contributed by upper thermocline anomalies.

(2) Lower precession results in positive mixed layer OHC anomalies in the core of warm pool (150ºE-150ºW, 20ºS-10ºN) and the subtropical northeastern Pacific, but with negative anomalies in other regions of the tropical Pacific. Upper thermocline layer OHC anomalies have similar patterns but with opposite signs relative to the mixed layer in regions between 15ºN-30ºS. As a combination, positive total OHC anomalies occupy large areas of 130ºE-120ºW from 30ºS to10ºN, while negative anomalies dominate the subtropical north Pacific, the western and eastern ends of the tropical Pacific.

If confirmed by paleoceanographic proxies, our simulated OHC results can be served as the first guide map of anomalous energetic storage & flows in the earth climate system under orbital forcings.