



The establishment of the atmosphere-wave-ocean circulation coupled models–The improvement of CGCMs’s simulations by the wave-induced vertical mixing

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There are several common problems of the coupled ocean-atmosphere general circulation models (CGCMs) without flux correction, such as too cold tongue, reversed zonal SST gradient in equatorial Atlantic, semi-annual cycle in the eastern tropical Pacific. The causes are not well understood yet. One possible reason maybe is the inaccurate reconstructed mixed layer (MLD) and thermocline structure, due to the insufficient vertical mixing in the OGCM. It is believed that the wave-induced vertical mixing can greatly improve the simulation of the MLD and thermocline in the ocean-only models. Based on the surface wave-circulation coupled theory, two atmosphere-wave-ocean circulation coupled numerical models, one based on the FGCM0, another based on the CCSM3, are established by incorporating the MASNUM wave number model. The model results indicate that the model with wave-induced mixing could simulate the climate system much better than the original CGCMs, such as the improvements on too cold tongue in tropical Pacific, SST deviation in tropical Atlantic and annual cycle in eastern tropical Pacific. The analysis shows that the surface wave plays a key role in the climate system and can much improve the performance of climate models on tropical biases. The wave-induced mixing is critically important for climate research and the improvement of the climate system coupled model.