Geophysical Research Abstracts
Vol. 13, EGU2011-8956, 2011
EGU General Assembly 2011

Distinguishing Sea Level Change due to Heating and Freshwater Input from Redistribution by Ocean Circulation

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The geographic variations of decadal sea level change are studied in relation to their global mean by analyzing regional differences of forcing and ocean circulation. An ocean general circulation model constrained by satellite and in situ measurements is employed to study the observed changes from 1993 to 2004. Regional sea level change is due mostly to changes in heat and freshwater content of the ocean. Vertically integrated regional mass changes, i.e. barotropic sea level trends, are negligible. The effects of external diabatic forcing and those of ocean circulation are distinguished from each other by using simulated passive tracers to quantify the relative change in heat and freshwater distribution driven by the different processes. Regional sea level change can largely be attributed to depth-dependent water mass redistribution by changing ocean circulation. Direct effects of heat and freshwater input are found to be secondary except for a warming in the warm pool region of the Equatorial Pacific Ocean. The nature of these changes and their implications will be discussed.