Geophysical Research Abstracts
Vol. 13, EGU2011-10551-1, 2011
EGU General Assembly 2011

The Hadley, Walker and monsoon circulations and their implications for the hydrological cycle during warm climates from transient coupled simulations

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The intensity of large-scale atmospheric circulation patterns such as the Hadley and Walker Circulation and the monsoon systems has been analyzed in transient simulations of warm climates representing the Eemian and Holocene, respectively. To this end a coupled atmosphere-ocean general circulation model (Kiel Climate Model) was forced by accelerated time-dependent orbital parameters corresponding to 126-115K BP and 9.5K BP-pre-industrial. The tropical circulation is decomposed into the Hadley, Walker and monsoon components to quantify their individual contribution to changes in atmospheric moisture storage and hydrological cycle change. Our model results show a strengthening of the Southern Hemisphere Hadley cell and its deeper extension into the Northern Hemisphere during boreal summer for the early Holocene and early Eemian (in comparison to pre-industrial). The individual contribution of the three main circulation systems to changes in vertical profiles of relative humidity and cloudiness is investigated.