Geophysical Research Abstracts, Vol. 7, 08848, 2005
SRef-ID: 1607-7962/gra/EGU05-A-08848

Trends and variability of water cycle components over global oceans from HOAPS II

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The Hamburg Ocean Atmosphere Parameters and Fluxes from Satellite Data set – HOAPS II - contains global fields of precipitation and evaporation over the global ocean and all basic state variables needed for the derivation of the fluxes. Except for the NOAA Pathfinder SST data set, all variables are derived from SSM/I satellite data over the ice free global ocean between 1987 and 2002. Pentade, monthly and climatological means are publicly available under www.hoaps.org with a spatial resolution of $^1/_2$ degree, which makes them ideally suited for studies of climate variability over the global oceans.

On a global scale HOAPS II exhibits a systematic and statistically significant increase of the atmospheric water wapor column content in consistence with a warming climate. The observed increase of about 1% per decade would correspond to an average global warming of about 0.1 degree per decade under the assumption of constant relative humidity. The data show also that the average evaporation since 1987 exceeds rain rate over the ocean systematically with almost negligible yearly cycle and small monthly variations. Regionally, this balance varies from approximately zero over the eastern North Atlantic and North Pacific up to more than 3mm/d in the subtropics and down below –3mm/d in the tropical ITCZ. The globally averaged trend of precipitation is very small and not significant over the 15 year study period, while evaporation does show a significant trend to increase during this time. This increase in evaporation is mostly confined to the subtropics and is due to a systematic increase in wind speed and in the difference between saturation sea surface humidity and atmospheric humidity. Precipitation shows some reduction in the subtropics, a substantial increase over the southern mid latitude oceans but no significant change

over the northern oceans. While the explanation of the findings for the extratropics are not straight forward, the subtropical trends hint clearly at a strengthening of the Hadley circulation during the last 15 years.