

Impact of climate change on the scaling of specific humidity with temperature over Japan

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The intensities of heavy rainfall events are expected to increase as climate warms, because the atmosphere can hold more water vapor at a rate of ~7% per 1 °C rise in temperature according to the Clausius-Clapeyron (CC) equation. The specific humidity in the atmosphere plays major role for such events. In our study, the scaling of specific humidity with respect to the temperature at different atmospheric levels are explored to understand their efficacy at each atmospheric level in causing heavy rainfall and their response to the d4PDF 4K warming. Our results indicated that at lower levels (below 850 hPa), the rate of change of specific humidity varies within the range of 6.9-7.5%/°C in present climate, while at 500 hPa the rate over southern Japan corresponds to 5.2%/°C and that over other regions shows within 6.9-8.9%/°C. These rates under d4PDF 4K warming climate showed slightly weaker, but the magnitude of the specific humidity with respect to temperature indicated increased values at all the levels which may fuel the rainfall events more and ultimately would bring much intensified heavy rainfall events in future warming climate.

Keywords: Heavy rainfall event, Clausius-Clapeyron relationship, Specific humidity