Investigation of Water Vapor Sources of China under the strong El Niño background during Summer 2015 using a Eulerian method

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An investigation on defining the water vapor sources of China and quantifying their relative contributions in summer 2015 using Weather Research and Forecasting model coupled with the chemistry module (WRF-Chem) is presented. The advection and diffusion of new water vapor (NWV) were simulated as pollutant while the evaporation is the emission of NWV. One control experiment and eight sensitivity experiments that separated different source regions were conducted. The control experiment was evaluated using reanalysis datasets and showed certain reliability. The results showed that during summer 2015 with the strong El Niño condition, the NWV transported from the ocean had dominant contribution over the south China while the NWV from the land was dominant over the north China, the area with much less precipitation amount. The NWV in China are around 56.2% from land and 43.0% from ocean. The contributions of the NWV from different ocean regions were calculated and indicated that the NWV in China was mainly provided by the Arabian Sea (14.7%), the Bay of Bengal (8.4%), and the Pacific Ocean (7.0%). The NWV from the Pacific Ocean mostly transported eastwards and had impact only on the coastal areas of China. The Atlantic Ocean have only limited effect over North China while the NWV of the Arctic Ocean barely arrived China. The simulation exhibited the general transport trends and distribution of vertical integrated NWV, which showed high reliability based on the comparison with previous studies. The paper provides a new Eulerian method to track the water vapor transport and quantify the contributions of different vapor sources using WRF-Chem model.