Changes in the intensity and frequency of atmospheric blocking and associated heat waves during northern summer over Eurasia in the CMIP5 model simulations.

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The Russia heat wave and wild fires of the summer of 2010 was the most extreme weather event in the history of the country. Studies show that the root cause of the 2010 Russia heat wave/wild fires was an atmospheric blocking event which started to develop at the end of June and peaked around late July and early August. Atmospheric blocking in the summer of 2010 was anomalous in terms of the size, duration, and the location, which shifted to the east from the normal location. This and other similar continental scale severe summertime heat waves and blocking events in recent years have raised the question of whether such events are occurring more frequently and with higher intensity in a warmer climate induced by greenhouse gases.

We studied the spatial and temporal distributions of the occurrence and intensity of atmospheric blocking and associated heat waves for northern summer over Eurasia based on CMIP5 model simulations. To examine the global warming induced change of atmospheric blocking and heat waves, experiments for a high emissions scenario (RCP8.5) and a medium mitigation scenario (RCP4.5) are compared to the 20^{th} century simulations (historical). Most models simulate the mean distributions of blockings reasonably well, including major blocking centers over Eurasia, northern Pacific, and northern Atlantic. However, the models tend to underestimate the number of blockings compared to MERRA and NCEP/DOE reanalysis, especially in western Siberia. Models also reproduced associated heat waves in terms of the shifting in the probability distribution function of near surface temperature.

Seven out of eight models used in this study show that the frequency of atmospheric blocking over the Europe will likely decrease in a warmer climate, but slightly increase over the western Siberia. This spatial pattern resembles the blocking in the summer of 2010, indicating the possibility of more frequent occurrences of heat waves in western Siberia. In this talk, we will also discuss the potential effect of atmosphere-land feedback, particularly how the wetter spring affects the frequency and intensity of atmospheric blocking and heat wave during summer.