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Physical processes associated with heat waves over Russia in a changing climate

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A companion study (Dole et al 2011) has considered potential causes for the extraordinary Russian heat wave that occurred from early July through mid-August 2010. That study concluded that this event was due primarily to natural internal atmospheric dynamical processes manifested by an extreme and persistent blocking pattern. There is, however, considerable evidence that human-caused climate change has contributed to previous heat waves in other regions, and is very likely to produce more frequent and extreme heat waves in many regions later this century. This study explores physical processes related to the occurrence of heat waves in western Russia in a changing climate with a focus on the role of dynamical processes and land-surface interactions. Model simulations are used to estimate the probability of exceeding various temperature thresholds over the period extending out to 2100. Influences of changes in mean temperatures and variability are considered. The results suggest that we may be on the cusp of a period in which the probability of such events will increase rapidly due to human-induced climate change.