IMPACTS OF STOMATAL RESISTANCE ON EVAPOTRANSPIRATION AND WATER YIELD IN CLIMATE CHANGE MODELING

Abstract

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May 2001

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Global climate changes caused by increased atmospheric concentrations of carbon dioxide (CO_2) and other greenhouse gases will change patterns of water yield. Increases in CO_2 affect water yield through changes in temperature, precipitation, runoff, and evapotranspiration (ET).

The Soil and Water Assessment Tool (SWAT) was applied to five sub-basins with different dominant land cover within the Missouri River basin to study the hydrologic responses under climate change conditions. The high-resolution climate change scenario developed from the National Center for Atmosphere Research (NCAR) Regional Climate Model (RegCM) was used to provide the climate change scenario.

25-year (1965-1989) period simulations were performed to study the impacts of increased CO_2 concentration, and changed climate on ET and water yield of these sub-basins respectively. Sensitivity analysis was also performed to study the effect of increased leaf area index on ET.

Results showed that ET decreased 3-11% due to a partial closure of leaf stomata under doubled CO_2 concentration. Water yield increased 13-38% correspondingly. When climate change scenario was added, ET increased compared to the simply doubling CO_2

concentration, some sub-basins show larger ET than that of baseline simulation, while water yield increased dramatically under climate change due to significant increases in precipitation based on the RegCM modeling results. The simulation of doubling leaf area index (LAI) showed little effect on ET and water yield.