Convective suppression before and during the 2017 northern Great Plains flash drought: Implications for forecasting

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Flash droughts intensify rapidly and tend to be disproportionately destructive. We demonstrate that the 2017 U.S. Northern Great Plains (NGP) flash drought was preceded by a breakdown of land-atmosphere coupling. Severe drought conditions in the NGP were first identified by drought monitors in late May 2017 and rapidly progressed to exceptional drought in July. The likelihood of convective precipitation in May 2017 in northeastern Montana, however, resembled that of a typical August when rain is unlikely. Based on the lower tropospheric humidity index, convective rain was suppressed by the atmosphere on nearly 50% of days during March in NE Montana and central North Dakota, compared to 30% during a normal year. Micrometeorological variables, including potential evapotranspiration, were neither anomalously high nor low before the onset of drought. Incorporating convective likelihood to drought forecasts would have noted that convective precipitation in the NGP was anomalously unlikely during the early growing season of 2017. It may therefore be useful to do so in regions that rely on convective precipitation.