Session: B2 Oral presentation

Increased hydroclimatic intensity with global warming

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Because of their dependence on water, natural and human systems are highly sensitive to changes in the hydrological cycle. A new measure of hydroclimatic intensity (HY-INT) is introduced, which integrates metrics of precipitation intensity and dry spell length, viewing the response of these two metrics to global warming as deeply interconnected. Although not directly an extreme index, HY-INT reflects the occurrence of extreme precipitation and drought events, as illustrated for example from the ability of HY-INT to capture recent hydroclimatic extremes in European climate. Using a suite of global and regional climate model experiments, we find that increasing HY-INT is a consistent and ubiquitous signature of twentyfirst century greenhouse gas-induced global warming. Depending on the region, the increase in HY-INT is due to an increase in precipitation intensity, dry spell length, or both. A range of late twentieth century observations over regions worldwide also exhibit dominant positive HY-INT trends, providing a hydroclimatic signature of late twentieth century warming. We find that increasing HY-INT is physically consistent with the response of both precipitation intensity and dry spell length to global warming. Precipitation intensity increases due to increased atmospheric water holding capacity. Rather, increases in mean precipitation are tied to increases in surface evaporation rates, which are lower than for atmospheric moisture. This leads to a reduction of the number of wet days and an increase in dry spell length. Our analysis identifies increasing hydroclimatic intensity as a robust and ubiquitous integrated response to global warming, implying increasing risks for systems that are sensitive to wet and dry extremes and providing a potential optimal target for detection and attribution of hydroclimatic changes.