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Higher hydroclimatic intensity with global warming

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Because of their dependence on water, natural and human systems are highly sensitive to change in the hydrologic cycle. We introduce a new measure of hydroclimatic intensity (HY-INT), which integrates metrics of precipitation intensity and dry spell length, viewing the response of these two metrics to global warming as deeply interconnected. Using a suite of global and regional climate model experiments, it is found that increasing HY-INT is a consistent and ubiquitous signature of twenty-first century, greenhouse gas-induce global warming. Depending on the region, the increase in HY-INT is due to an increase in precipitation intensity, dry spell length, or both. Late twentieth century observations also exhibit dominant positive HY-INT trends, providing a hydroclimatic signature of late twentieth century global warming. Precipitation intensity increases because of increased atmospheric water-holding capacity in warmer conditions. However, increases in mean precipitation are tied to increases in surface evaporation rates, which are lower than for atmospheric moisture. This leads to a reduction in the number of wet days and thus an increase in mean dry spell length. This analysis identifies increased hydroclimatic intensity as a robust integrated response to global warming, implying increasing risk of dry and wet extremes and providing a potential target for detection and attribution of hydroclimatic changes.