



## **Contrasting responses of terrestrial eco-hydrologic quantities to climate change**

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Much recent literature on terrestrial hydroclimate under planetary warming has concluded that continents will become "drier" in some important sense. However, paleoclimatologists have usually interpreted cold, low-greenhouse periods to be "dry" on land and warmer epochs to be "wet," and other modern-climate studies have come to similar conclusions. Here, we show that both of these ideas are fundamentally misleading: under CO<sub>2</sub>-driven warming, climate models strongly decrease surface soil moisture and near-surface relative humidity, yet strongly increase photosynthesis and vegetation cover (a main objective of hydroclimatology), moderately increase runoff production, and barely change deep-layer soil moisture.

This holds both for future anthropogenic warming and for glacial-interglacial warming: the models project wet surfaces with decreased photosynthesis at the last glacial maximum. Thus, the paucity of forest cover and expanse of open habitat in the LGM record is actually consistent with the models, and does not imply that the glacial environment was "dry", but merely that CO<sub>2</sub> was low. In contrast, in order to explain the paleo-record without invoking a CO<sub>2</sub> effect on vegetation, one would likely have to conclude that the LGM (and future) surface moisture projections are grossly incorrect.

In short, the words "drier" and "wetter" are not sufficient to describe greenhouse terrestrial climate change past, present or future, and their use in isolation is discouraged.