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Aridity under conditions of increased CO_2

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A string of recent of studies led to the wide-held assumption that aridity will increase under conditions of increasing atmospheric CO_2 concentrations and associated global warming. Such results generally build upon analyses of changes in the 'aridity index' (the ratio of potential evaporation to precipitation) and can be described as a direct thermodynamic effect on atmospheric water demand due to increasing temperatures. However, there is widespread evidence that contradicts the 'warmer is more arid' interpretation, leading to the 'global aridity paradox' (Roderick et al. 2015, WRR). Here we provide a comprehensive assessment of modeled changes in a broad set of dryness metrics (primarily based on a range of measures of water availability) over a large range of realistic atmospheric CO_2 concentrations. We use an ensemble of simulations from of state-of-the-art climate models to analyse both equilibrium climate experiments and transient historical simulations and future projections. Our results show that dryness is, under conditions of increasing atmospheric CO_2 concentrations and related global warming, generally decreasing at global scales. At regional scales we do, however, identify areas that undergo changes towards drier conditions, located primarily in subtropical climate regions and the Amazon Basin. Nonetheless, the majority of regions, especially in tropical and mid- to northern high latitudes areas, display wetting conditions in a warming world. Our results contradict previous findings and highlight the need to comprehensively assess all aspects of changes in hydroclimatological conditions at the land surface.

Roderick, M. L., P. Greve, and G. D. Farquhar (2015), On the assessment of aridity with changes in atmospheric CO_2, *Water Resour. Res.*, **51**, 5450-5463