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The impact of elevated CO_2 on the energy and water balance over terrestrial surfaces

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When we think of the enhanced greenhouse effect, the tendency is to focus on the effects on near-surface air temperature and the consequence impacts. On that approach the underlying cause of the enhanced greenhouse effect, that is, increasing atmospheric CO_2 tends to be ignored. But laboratory experiments have long shown that increasing CO_2 has a large impact on vegetation gas exchange, by, for example, increasing water use efficiency of photosynthesis. This tends to be a forgotten factor in the meteorological and hydrologic sciences. In this talk we outline some key expected effects of atmospheric CO_2 on leaf-, canopy- and catchment-scale fluxes and compare those expectations with both site- (e.g. FACE) and catchment-scale observations. We find the expected effects have been observed over undisturbed vegetation. However, we find the effects of elevated CO_2 are more complex in disturbed vegetation that is actively regrowing, This finding suggests the disturbance history will be a key factor on the canopy- and catchment-scale responses to elevated CO_2.