



Effect of irrigation on the Budyko curve: a process-based stochastic approach

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Currently, 40% of food production is provided by irrigated agriculture. Irrigation ensures higher and less variable yields, but such water input alters the balance of transpiration and other losses from the soil. Thus, accounting for the impact of irrigation is crucial for the understanding of the local water balance. A probabilistic model of the soil water balance is employed to explore the effects of different irrigation strategies within the Budyko framework. Shifts in the Budyko curve are explained in a mechanistic way. At the field level and assuming unlimited irrigation water, irrigation shifts the Budyko curve upward towards the upper limit imposed by energy availability, even in dry climates. At the watershed scale and assuming that irrigation water is obtained from sources within the same watershed, the application of irrigation over a fraction of the watershed area allows a more efficient use of water resources made available through precipitation. In this case, however, mean transpiration remains upper-bounded by rainfall over the whole watershed.