Orographic Uplift as Global Thermostat: Orography, Winds and the Water Vapor Feedback in Climate Models*

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One of the grand challenges in geosciences is the interaction and feedbacks between climate and tectonics: growing mountains change the local climate and that climate then affects erosion, a significant factor in the creation and development of mountains. Coupled climate models with similar atmospheric forcing but differing orographies are ideal to examine the interplay between the orography, monsoonally-driven variability and the simulation of precipitation and aridity. Topography wrings out moisture from the atmosphere affecting the local precipitation, specific humidity and the surface specific humidity gradient. The models reproduce this orographically-focused precipitation; the patterns of aridity in the models, specifically the existence of "drylines", are highly correlated with the topographic details (mountain volume and area of higher elevation). Given that water vapor is the most powerful greenhouse gas in the atmosphere, a drier atmosphere produces a colder planet. Regional precipitation maxima created by orography may leave the atmosphere drier globally. The global effects of orography on aridity and temperature through the water vapor feedback necessitate a mountain-water vapor feedback to reconstruct past global climate. Coincidental climate-change during the uplift of major orographic features provides support for this analysis.