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Uplift and Erosion Histories of Continents From Inversion of Drainage Networks

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The uplift history of the Earth's surface contains important information about mechanisms of uplift. The uplift histories of Africa and Australia, for example, contain clues about the temporal and spatial evolution of mantle convection. Constraining uplift histories on continental length-scales is usually difficult because measurements of uplift or denudation (e.g. thermochronometry) are limited by their spatial resolution. We show that shapes of longitudinal river profiles contain information that can be used to invert for continental uplift rate histories. To invert river profiles for a history of uplift we first calibrate an erosional model. We show how stream-power models can be calibrated by jointly inverting families of longitudinal river profiles in Africa. We jointly invert 720 river profiles from Africa and 320 rivers from Australia for smooth histories of Cenozoic uplift. Our results indicate that geodynamic predictions of mantle convection fail to accurately predict changing patterns of dynamic support.