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Steam Cooking of the Andes: A Comparison from North to South

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Subduction related orogeny at the pacific margin has led to one of the largest and highest plateaus on Earth in the Central Andes, whereas the southern part of the Andean orogen lacks a plateau despite plate kinematic boundary conditions being roughly the same along the entire orogen. The central Andean high plateau is characterized by geophysical anomalies, such as a high heat flow density exceeding 100 mW/m^2, a crustal thickness of about 70 km, a high Bouguer anomaly, an extreme electrical conductivity anomaly, and low velocity zones. However, these anomalies strongly vary from north to south. To better understand the underlying processes generating this high plateau and the observed variations, we need to identify and quantify the controlling parameters of the Andean evolution. We present a conceptual model to explain the observed heat flux by advective heat of water through the mantle wedge. Part of the high amount of fluids which is subducted with the down-going slab is released beneath the mantle wedge. The ascending water is heated in the hot mantle wedge. The fluids carry heat into the crust causing heat flow density to be significantly enhanced. This phenomenon, which we call “steam cooking”, leads to a number of consequences, which allow to explain the triggering of the Central Andean evolution, the high heat flux, partial melting of the crust, and the strong variation from North to South of geological, petrological, and geophysical observations.