# Rainfall thresholds for the stability of carbonate and iron oxide minerals in the monsoon regions

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Carbonate and iron oxide minerals are abundant in soils and sediments; their stability and reactivity are sensitive to climate change, especially rainfall variation. However, their quantitative relationship to rainfall remains poorly defined. Here we present the rainfall thresholds for the stability of carbonate and iron oxide minerals in monsoon regions.

For the carbonate mineralswe investigate the variation of calcite and dolomite from eight loess-paleosol sections on the Chinses Loess Plateau. We find that with the increasing monsoon rainfall four dissolution phases of carbonate minerals can be identified: (1) with mean annual rainfall (MAR) < 610 mm, coexistence of detrital dolomite and calcite; (2) 610 < MAR < 690 mm, calcite without detrital dolomite; (3) 690 < MAR < 725 mm, both detrital dolomite and calcite are absent, but there is no downward leaching; (4) MAR > 725 mm, both detrital dolomite and calcite are absent and downward leaching into the underlying loess layer occurs.

The content of iron oxide minerals (hematite, goethite and maghemite) in soils and sediments is also controlled by climate through weathering and pedogenesis. A positive correlation is observed between these iron oxides and rainfall in well drained temperate zone soils. However, in high rainfall areas (MAR > 1200-1400 mm), both hematite concentration and magnetic susceptibility decrease with increasing rainfall, whereas goethite concentration displays a large increase. Before the soil environment turns anaerobic goethite is the favored mineral phase of iron oxide with increasing rainfall and accumulates at the expense of hematite and maghemite through the dominance of rainfall-driven pedogenic processes.

Based on these observations, a model relating carbonate and iron oxide minerals to monsoon rainfall is proposed and discussed in the presentation.