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# Soil erosion and weathering in a hummocky moraine landscape

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Global change is expected to affect landscapes and mass fluxes from and into soils. Three sets of processes shape these changes: weathering, soil profile development and lateral redistribution of material. It is well known that these interact strongly. Periods with dominantly progressive soil forming processes (weathering) alternate with periods with dominantly regressive processes (erosion). As a result, short-term soil redistribution (years to decades) can differ substantially from long-term soil redistribution (centuries to millennia). In the formerly glaciated areas of the lowlands of Uckermark, NE Germany, agriculture has strongly intensified since the early 60s, which has led to an increase in erosion and deposition (soil redistribution). We have therefore the following research questions: 1) How do long-term rates of lateral soil redistribution processes differ from short-term rates? 2) How are weathering rates related to long- and short-term soil redistribution rates?

The investigations are carried out on the experimental CarboZALF site that is in a hummocky ground moraine landscape, characterised by kettle holes. We compare short-term erosion rates using $^{239+240}$Pu and long-term soil erosion using cosmogenic $^{10}$Be (in situ and meteoric $^{10}$Be). Furthermore, long-term weathering rates are presented (by using immobile elements as tracers) and compared to the mass redistribution rates. Three specific profiles have been analysed in detailed: the hillslope profiles ‘LP12N’ and ‘Vamos’, and a profile, ‘LP4’, on a flat position. Our results show that the short-term mass redistribution rates are about one order of magnitude higher than the average long-term redistribution rates. The profiles LP4 and VAMOS exhibit a slight accumulation over the long-term. The site VAMOS should, from a topographical point of view, be erosive. Erosion was, however, counterbalanced by the deposition of eroded (upslope) soil material about 2 ka BP ($^{14}$C-dated). This demonstrates that strong events of soil mass redistribution are not only a result of present-day activities (agriculture). Regarding the chemical mass balance of soils, moderate to strong losses were determined for LP4 and LP12N. On the contrary, the site Vamos showed a slightly positive mass balance. The relative losses of major elements such as Ca or Si correlate with the measured trends of soil redistribution, with intense, vertical chemical leaching at flat positions, lateral transport and leaching on slope positions and accumulation at the footslope. The multi-isotope approach demonstrates that temporarily changing processes can be disentangled in their major traits.