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A new perspective on soil erosion: exploring a thermodynamic approach in a small area of the River Inn catchment

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Soil erosion modeling has always struggled with compensating for the difference in time and spatial scale between model, data and the actual processes involved. This is especially the case with non-event based long-term models based on the Universal Soil Loss Equation (USLE), yet USLE based soil erosion models are among the most common and widely used for they have rather low data requirements and can be applied to large areas. But the majority of mass from soil erosion is eroded within short periods of times during heavy rain events, often within minutes or hours. Advancements of the USLE (eg. the Modified Universal Soil Loss Equation, MUSLE) allow for a daily time step, but still apply the same empirical methods derived from the USLE. And to improve the actual quantification of sediment input into rivers soil erosion models are often combined with a Sediment Delivery Ratio (SDR) to get results within the range of measurements. This is still a viable approach for many applications, yet it leaves much to be desired in terms of understanding and reproducing the processes behind soil erosion and sediment input into rivers. That's why, instead of refining and retuning the existing methods, we explore a more comprehensive, physically consistent description on soil erosion. The idea is to describe soil erosion as a dissipative process (Kleidon et al., 2013) and test it in a small sub-basin of the River Inn catchment area in the pre-Alpine foothills. We then compare the results to sediment load measurements from the sub-basin and discuss the advantages and issues with the application of such an approach.