EGU22-12269, updated on 19 Aug 2022
https://doi.org/10.5194/egusphere-egu22-12269
EGU General Assembly 2022

Time series analysis using global satellite remote sensing data archives for multi-temporal characterization of hazardous surface processes

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The Earth's surface hosts a large variety of human habitats being subject to the simultaneous influence of a wide range of dynamic processes. The resulting dynamics are mainly driven by a complex interplay between geodynamic and hydrometeorological factors in combination with manifold human-induced land use changes and related impacts. The resulting effects on the Earth's surface pose major threats to the population in these areas, especially under the conditions of increasing population pressure and further exploitation of new and remote regions accompanied by ongoing climate changes. This situation leads to significant changes in the type and dimension of natural hazards that have not yet been observed in the past in many of the affected regions.

This situation has been leading to an increasing demand for systematic and regular large area process monitoring which cannot be achieved by ground based observations alone. In this context, the potential of satellite remote sensing has already been investigated for a longer period of time as an approach for assessing dynamic processes on the Earth's surface for large areas at different spatial and temporal scales. However, until recently these attempts have been largely hampered by the limited availability of suitable satellite remote sensing data at a global scale. During the last years new globally available satellite remote sensing data sources of high spatial and temporal resolution (e.g., Sentinels and Planet) have been increasing this potential to a large extent.

During the last decade, we have been pursuing extensive methodological developments in remote sensing based time series analysis including optical and radar observations with the goal of performing large area and at the same time detailed spatiotemporal analysis of natural hazard prone regions affected by a variety of processes, such as landslides, floods and subsidence. Our methodological developments include among others large-area automated post-failure landslide detection and mapping as well as assessment of the kinematics of pre- and post-failure slope deformation. Our combined optical and radar remote sensing approaches aim at an improved understanding of spatiotemporal dynamics and complexities related to the evolution of these hazardous processes at different spatial and temporal scales. We have been developing and applying our methods in a large variety of natural and societal contexts focusing on Central Asia, China and Germany.

We will present selected methodological approaches and results for a variety of hazardous surfaces processes investigated by satellite remote sensing based time series analysis. In this we will focus on the potential of our approaches for supporting the needs and requirements imposed by the disaster management cycle representing a widely used conceptual approach for disaster risk reduction and management including, rapid response, long-term preparedness and early warning.