New Insights in the Rheology of a Deep-seated Landslide Based on the Analysis of Long-term Geodetic Monitoring Data

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KEY WORDS: Applications in Geotechnical and Structural Engineering

ABSTRACT:

Despite the ongoing research on landslides, disasters such as those caused by the recent landslides in Brazil and Central America early in 2011 continue to occur. This study aims to the better understanding of landslide kinematics and rheology, a crucial step towards the landslide forecasting and prevention.

The exceptionally long geodetic monitoring record of the Mandria landslide at the Polyphyton dam reservoir (NE Greece) was further analysed. Previous studies based on the same data and spectral analysis identified multi-annual periods in the horizontal movements of the landslide. For landslides of this type a causative relationship between the landslide movement and the precipitation or the reservoir water level is commonly found. However, for the Mandria landslide no such relationship was possible to be established.

We applied a high-pass filter and cross-correlation and found a 2 year time lag between the reservoir level and the landslide movement and between the precipitation and the landslide movement. The results were validated using the consolidation theory.

Due to the semi-arid climate of Greece, most of the precipitation becomes runoff. Still, a small amount is possible to reach the slip surface through fissures and cracks on the sliding mass. The precipitation in combination with the reservoir level increase the pore water pressure and decrease the effective stress resulting in slope instability and failure. This process could take up to 2 years for the water to reach the failure plane which is consistent with the unexplained multi-annual periodicities found previously.