Geophysical Research Abstracts
Vol. 15, EGU2013-7555, 2013
EGU General Assembly 2013

Relationships between precipitation, seismic noise and river chemistry in a well-instrumented mountain catchment

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Recent work (e.g. Burtin et al. 2008, Hsu et al. 2011) has shown continuous recording of seismic noise with a close-knit network of seismometers can be used to locate geomorphic events within a catchment, both spatially and temporally. Although this has significance for modelling of physical erosion within a landscape, the link between these events and chemical weathering is not as clearly defined. The role that precipitation plays in triggering these events as well as its influence on seismic noise is also in need of clarification, particularly as many of the events would not be visible from aerial mapping alone (Burtin et al., in review).

This study uses a series of datasets collected during the summer of 2010 in a well instrumented, mountainous catchment in Taiwan to better elucidate these connections. High frequency recording of rainfall, continuous seismic noise recording and daily records of river chemistry and suspended sediment load are used to look at the short term controls on geomorphic activity and the resulting chemical weathering.

A close tie is found between rainfall intensity and timing of seismically located geomorphic events, likely indicating reactivation of existing landslide scars. An exponential increase in the efficiency of activation is seen with increasing rainfall, even during a relatively quiescent typhoon season. This corresponds to the increase in seismic noise with increasing rainfall following a power-law relationship.

In terms of the chemical weathering data, 72 hour prior average seismic noise is quite well correlated ($p=0.703$) with river ratios of Ca/Sr, giving an independent constraint on the rate of carbonate reprecipitation. Measurement of river water chemistry in two locations within the catchment reveals significant local disparities in major cation concentrations, likely caused by lithological differences and variable hydrothermal input. Hydrograph deconvolution using stable isotopes will allow for separation of these components, showing their rapid variability.

The use of a range of high recording frequency data sources allows a more process focused approach to the weathering budget, whilst the close link between rainfall intensity and event triggering could help highlight periods of increased risk of landslide in this type of catchment.