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At least 500 post-glacial catastrophic rockslides/rock avalanches in the Alps: Is there a message?

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An idea often suggested is that rockslide/rock avalanche 'activity' (frequency and/or magnitude) is coupled with (a) earthquakes, and/or (b) climatic change (e.g. relative humid-arid cycles, global warming). The problem with such interpretations is that they require the age-dating of a statistically significant number of events to be known in order for a correlation or non-correlation with earthquake activity and/or with climatic changes.

Even in the Alps, with their unparalleled data density only for a mere 7% of at least 500 post-glacial rockslides/rock avalanches $>10^6$ m^3, the mean age is sufficiently well-constrained to be potentially useful in comparison with past climatic change or earthquake activity; taking into account the 13% of historical events, this still leaves nearly 80% of all rockslide events $>10^6$ m^3 completely undated. Several previous compilations stated a correlation of mass-wasting activity with climatic changes; one problem with such compilations, however, is that they frequently mix earthflows and/or mud flows, boulder debris flows, and rockfalls, into the same category of 'mass-wasting'. In addition, the amount of data available from the 7% of age-dated post-glacial rockslides with a volume $>10^6$ m^3 is insufficient to lend themselves to studies on time scales of hundreds to thousands of years; so, the causal relationship between the measured events of 'mass-wasting' and the frequency of rockslides $>10^6$ m^3 is too conjectural.

Considering rock mechanics, the record of historical rockslides, and the few age-dated pre-historical rockslide events, all indicate that the major obstacles in finding a clear-cut correlation with climatic change and earthquakes are the long relaxation and reaction times involved in the triggering of catastrophic rockslides. In addition, whilst climatic changes are fairly well-documented for the late-glacial to Holocene times, the archaeo- to palaeoseismic record is very scant; this further impedes a correlation of rockslide frequency/magnitude with a particular triggering factor. Based on the geological snapshot provided by the present Alps and its catastrophic rockslides, we conclude that on a scale of millions of years, rockslides should be of roughly equal probability over the entire extent of an orogen (except for gently-folded, relatively low-relief externides subject to late uplift). Orogenic surface uplift and development of major faults or tectonic windows are the first-order controls over rockslide activity, independent of climate or earthquake activity. Further study is needed to test whether this basic pattern of 'long-term-distribution' in space and time of rockslide $>10^6$m^3 probability can be *modulated* by climatic change and earthquake activity, and if so to what extent.