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Recent advance in lichenometry: the GEV method with an application in the tropical Andes

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Lichenometry is a dating method, traditional in geomorphology, which can be used to date old monuments or periglacial landforms. Developed in the fifties by the botanist Beschel to date glacial extension in the Alps, this method is based on diameter measurements of certain species of lichens (association between an alga and a fungus) which colonize a rock substrate. This dating method is very efficient in high altitude or high latitude environments because vegetation is scarce, making dendrochronology not easily usable. While lichenometry can provide date estimates of Holocene age surfaces, it is particularly applicable over the five last centuries. In comparison, the classical 14C absolute dating method is difficult to apply for this time period. Since its development at the beginning of the sixties, many approaches have been proposed, most of them, however, suffer from two major problems: (i.) the statistical analyses were not appropriate to the type of data, (ii.) in most cases confidence intervals were not generated. Here we present a new method based on extreme value theory coupled with a Bayesian approach. Comparisons with classical methods revealed that this new procedure makes possible to solve the two problems described above. An application of this method is made on moraines of a tropical glacier in order to document the retreat over the last centuries and estimate palaeo-climatic conditions responsible for this evolution.