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Interplay between uplift and tectonic preformation: a Surface Processes Modelling attempt for the Inntal Fault (Eastern Alps)

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The Inntal Fault, a major strike-slip tectonic feature hosting the valley of the river Inn in the Eastern Alps, is assumed to be active since the Miocene times. The fault is running obliquely to the orogenic fault. The deformation is still going on, as the present earthquake pattern demonstrates.

Beside of the lateral motions the area is affected also by vertical movements consisting of at least two components: in the long term, the collision of the African and European plates force the vertical movements, whereas for shorter periods of the postglacial isostatic rebound contributes considerably to the present uplift. There is also evidence for a temporal change in the uplift pattern of the area, that is approximately 5 Ma ago the uplift rates might have doubled to reach the present rate.

This composite tectonic behaviour together with the complex lithology of the area makes the region not well suited for Surface Processes Modelling (SPM), since the number of parameters needed for the modeling is rather large, and they are difficult to estimate.

To be able to study the area with SPM we made a number of simplifying assumptions. We assumed that the position of the fault remains the same in the sense that we replace the fault with a narrow zone of high erodibility rocks and so the blocks that move away

in the nature, remain fixed in the model. Furthermore, according to literature data, we assumed that NW of the Inntal Fault the area is already mountainous, while in the east and southeast there is a rather flat, somewhat hilly region. The uplift starts from this initial setting. The lithology has also been simplified.

With various erodibilities and uplift rates we obtained results being in accordance with the expectations. In most of the models the river Inn (the main trunk channel in the model) flows along the weak zone (that is the main trunk channel is oblique to the orogenic front). At the exit point on the orogenic front, a talus cone is formed. In some models, especially if the uplift rate have been increased for a given period of time, some valleys in the mountainous part are cutting back so fast, that one of them can behead the Inn valley deflecting the watercourse and gaining extra drainage area together with discharge. So the watercourse can establish itself leaving a hanging valley behind. These results are very similar to what we can observe in the area. Of course to refine these models, later some effects that have been neglected so far should be incorporated into the model (e.g., the real strike-slip motions of the rock bodies.)

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