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# Rate and pattern of drainage network growth and induced drainage divide migration in natural (Aude river catchment, France) and laboratory-scale landscapes

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The topography of continents is a dynamic interface that evolves in response to several external (tectonics, mantle dynamics, climate) or internal factors to the geomorphic system. If these systems tend naturally toward a steady-state, they often show transient regimes as evidenced by retreating knickpoints, fluvial captures or migrating divides. These two last phenomena are indicative of drainage reorganization and imply the growth of a network at the expense of another. Yet, the rate of drainage network growth is very poorly known. To our knowledge for example, only one study (Craddock et al., 2010) has attempted to constrain the rate of growth of a natural drainage network, in the specific case of a growth by sequential captures of endorheic systems.

Our aim here is to constrain the mechanism, timing and rates of network growth and drainage reorganization in a natural setting located in southwest France (Aude river catchment), in a current anorogenic setting in the northern foreland of the Pyrenees.

Geomorphic evidence indicate that this catchment is enlarging with about 40 km of displacement of its main divide in the last few hundreds of thousand years (precise timing under investigation). The Aude river and main tributaries show flight of strath terraces that converge downward over ~150 km long distance. This specific fan-shape of paleo-longitudinal profiles implies an upward increase of fluvial incision that we interpret as the consequence of a long-term growth of the Aude drainage network. The dating of these terrace system using cosmogenic isotopes (in-situ $^{10}$Be depth-profiles and $^{10}$Be-$^{26}$Al burial isochrones) and Electron Spin Resonance (ESR) is under progress and will allow us to quantify the longitudinal trend of differential incision through time, which we will use to estimate the rate of drainage network growth and divide migration. To support these results, an analysis of the catchment-wide erosion rates on both sides of the migrating divide is also performed. First preliminary results indicate catchment-wide erosion rates of 0.06-0.08 mm.yr$^{-1}$ in the Aude river catchment.

In complement to this natural case study, the main question of network growth dynamic is also addressed through laboratory-scale experiments performed at the Géosciences Environnement

Toulouse (GET) laboratory. The first results show that the divide migration rate related to drainage network growth depends positively on the uplift/base level fall rate. In the detail, the divide migration rate is however non-linear, it evolves step by step with periods of acceleration when cyclic retreating knickpoints hit the divide.

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