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Reconstructing the Earth in Deep-Time: A New and Open Framework for the PANALEISIS Model

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The Panalesis model (V  rard, 2019) was developed in a preliminary version according to concepts, methods and tools that follow the work carried out for more than 20 years at the University of Lausanne (Stampfli & Borel, 2002; Hochard, 2008). Although the techniques are relevant, development under ArcGIS   does not allow visibility and easy accessibility of the model to the scientific community.

A major effort is therefore underway to migrate the entire model to an open source version using a FAIR approach for research software (Chue Hong *et al.*, 2021). This migration concerns both the plate tectonic maps covering all the world over the entire Phanerozoic and part of the Neoproterozoic, but also the creation of paleoDEMs (global quantified topographies).

The Panalesis model and its entire architecture is therefore currently migrated to QGIS (a free and open source geographic information system). TopographyMaker, the software designed to convert polylines from the reconstruction map into a points grid with elevation values is now working as a plugin on QGIS. The output palaeoDEMs will also be published according to the FAIR principles for scientific data management and stewardship (Wilkinson *et al.*, 2016).

The development and future refinements of TopographyMaker will enhance the Earth system modelling, especially coupling between models of different shells of the Earth such as atmospheric circulation, climatic evolution, and mantle dynamics. The topography is, for instance, considered a first order controlling factor for CO₂ evolution over geological timescales, through silicate weathering (MacDonald *et al.*, 2019).