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Linking lithosphere deformation and sedimentary basin formation over multiple scales

Huismans, R.S.¹

¹Department of Earth Science, Bergen University, Bergen, Norway, Ritske.Huismans@uib.no

Here we focus on the relationships between tectonic deformation and sedimentary basin formation. Resolving the interaction and feedback between tectonic crust-lithosphere scale deformation and surface processes through erosion of elevated areas and formation of sedimentary basins over multiple scales has been a long-standing challenge. While forward process based models have been successful at showing that a feedback is expected between tectonic deformation and redistribution of mass at the earth's surface by erosion, transport, and deposition, demonstrating this coupling for natural systems has been an even greater challenge and is strongly debated. Observational constraints on crust-lithosphere deformation and surface processes are typically collected at highly varying spatial and temporal scales, while forward process based models are typically run at either very large lithosphere-mantle scale, or at the scale of the sedimentary basin making it difficult to investigate and explore the detailed interaction and feedback between these systems. Here I will report on recent advances in forward modelling linking crust-lithosphere deformation with surface processes over a large range of scales resolving tectonic plate scale deformation and sedimentary basin formation at stratigraphic scales. The forward numerical models indicate a linkage and interaction between the structural style of thick-skinned large-scale mountain belt and rift-passive margin formation, erosion-transport-deposition processes operating at the surface, and the thin-skinned deformation occurring in the associated sedimentary basins.

