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Tectonic stresses associated with mid-oceanic ridge and passive margins of Arctic

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How important is the Earth curvature and its local topography to the lithospheric deformation? How big is the influence of lithospheric flexure in the balance of stresses during tectonic deformation? How important are mid-oceanic ridges in the balance of stresses in the Arctic region and what is the significance of other driving mechanisms on the stress conditions along the passive margins of the region? To approach the relation between deep processes and topography, we apply new types of numerical analysis. Ideally, the Earth's lithosphere should be modelled in 3D, but direct 3D numerical models are still computationally expensive (if possible at all). Thus alternatively, we apply semi-analytical numerical methods (e.g., thin-sheet, thick-plate, shell approximations combined with the shell finite-elements) in a prototype-code "ProShell". This method allows analysis of the stresses in Earth-like spherical models using real topographical data in combination with other available data (such as thickness of the Greenland ice sheet, age of ocean floor, Moho depth). We apply the code to model regional stress fields on the scale of the Arctic and more detailed local stress fields on the scale of central East Greenland. Conceptionally, our most important finding is that results of models that acknowledge the "crumpled spherical" geometry of the Earth, highly contrasts that of conventional "flat Earth" numerical models. Perhaps our most controversial finding is that the horizontal stress component acting from the East Greenland Mountain Chain (comparable to the Alps in size) far exceeds that of the push from the adjacent Mid Atlantic Ridge. We test this result against on- and offshore geological data of Cenozoic domes and folds, typically envisioned as caused

by ridge push. For example, large-scale folds in East Greenland formed before the oceanic ridge, and thus cannot be formed by ridge push. Collectively, the data suggest that we need to reconsider the engine behind horizontal forces locally and, perhaps, globally, so that the horizontal component of topographic forces is considered equal to that of the underlying forces.