Abstract: Over the last decade, Antarctica's dominant contribution to sea-level rise was caused by dynamic changes (e.g. acceleration and thinning) of its outlet glaciers that are in contact with the ocean. While the spatial patterns of mass loss can by now be observed in great detail using satellite observations, the underlying mechanisms are unclear and models struggle to capture the abrupt changes in ice dynamics. This results in large uncertainties for sea-level rise projections. In part this stems from uncertainties associated with ice rises, which are locally grounded features in otherwise floating ice shelves that act as obstacles to ice-shelf flow. They are typically tens to a few hundred kilometers in diameter and can be viewed as mini ice sheets within the larger ice sheet. Unpinning of an ice shelf from ice rises may trigger ice-shelf collapse and sudden sea-level rise. Ice rises have a local ice flow centre that is independent from the main ice sheet. Their internal structure archives the ice sheet's history, presenting the potential to use these features as constraint for paleo ice-sheet simulations in areas where other constraints such as from geological evidence are absent. Up to now, less than 5% of the 700 ice rises surrounding Antarctica have been studied and therefore the conditions that lead to their formation, stability, and decay are still poorly understood. The flow characteristics of ice rises requires the use of a sophisticated ice-sheet model that does not rely on simplifying assumptions to the underlying mathematical formulation of ice flow. We will use a 3D full-Stokes ice-sheet model to test conditions that lead to the formation of a stable steady-state ice rise and investigate processes that may lead to changes in their geometry and ice-rise instability. In this project, we employ a two-step approach in which we start with simulating ice rises in a synthetic setup, before we apply the same setup to real-world geometries. The advantage of starting with the synthetic setup is that it removes complications like model initialisation and inconsistencies between input datasets from the simulations, allowing us to tease out the effect of the applied perturbation more cleanly. For the real-world geometries, our model simulations will be validated against already acquired radar data. The results will significantly contribute to the effort to unlock the potential of using ice rises as an additional constraint in paleo ice-sheet simulations. A better process understanding of ice rises however goes beyond the ice-rise community, but would be beneficial for continental-scale ice-sheet models as they commonly ignore or at best parameterise the effect of ice rises.