Geophysical Research Abstracts
Vol. 21, EGU2019-7362, 2019
EGU General Assembly 2019

Removing Tides and Inverse Barometer Effect on DInSAR of Antarctic Ice Shelves

Quentin Glaude (1,2), Sophie Berger (3), Charles Amory (4), Frank Pattyn (1), Christian Barbier (2), and Anne Orban (2)

(1) Université Libre de Bruxelles, Laboratoire de Glaciologie, Brussels, Belgium, (2) Centre Spatial de Liege, Université de Liège, Angleur, Belgium, (3) Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany, (4) Laboratoire de Climatologie et de Topoclimatologie, Université de Liège, Liège, Belgium

Since they restrain the flow of upstream grounded ice, ice shelves are major components of the Antarctic ice-sheet dynamics. Monitoring these ice shelves and their evolution can be achieved by analyzing horizontal velocities. In this context, DInSAR has been intensively used to produce highly accurate velocity fields.

The principle of DInSAR is to subtract the phase of two coherent radar waves to produce an interferogram, from which it is possible to extract a displacement. Because SAR sensors emit their signal in an oblique direction, it is the vector sum of the vertical and horizontal displacements along the line of sight (LOS) that is measured, rather than individual components. The horizontal displacements are caused by a horizontal motion of ice, which can be assumed stable on monthly scales. On the other hand, the vertical displacements of ice shelves are mainly due to short-term variations of the local sea level, which are directed by tides and variable atmospheric pressure, known as inverse barometer effect. On the grounded part of the ice-sheet the vertical response to the tides and pressure variations is negligible. On the floating part, the vertical displacement follows oceanic readjustments. In the grounding zone, the progressive response from grounded to floating areas to sea-level change is translated into a high fringe rate in the differential interferogram.

When interpreting the LOS measurement as solely due to horizontal movements, any vertical bias will inevitably lead to errors in the horizontal velocity estimate. In low velocity areas, this bias has approximately the same magnitude as the measured speed, leading to misinterpretation of the ice dynamics.

In the present work, we present an empirical technique using Sentinel-1 radar satellite and regional models to estimate and remove the corresponding bias and show preliminary results on the Roi Baudouin Ice Shelf (RBIS) in Dronning Maud Land (Antarctica).