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Structure and dynamics of Wilkins Ice Shelf (Antarctic Peninsula) by means of multi-sensor remote sensing

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The Wilkins Ice Shelf (WIS), a thin ice shelf in the Bellinghausen Sea, has considerably declined in the past two decades and thus, it is of general interest to investigate its stability and recent changes. The WIS is located in an area of the supposed limit of viability of ice shelves, namely the -9˚C isotherm of mean annual ice surface temperature. In-situ observations are very scarce on WIS and hence various remote sensing technologies and products are combined in order to improve the understanding of the current and near-past structure and dynamics of the ice shelf and its tributaries. We document the retreat of the ice front of the WIS from 1986 to 2007, as well as the formation of cracks and extent of melt ponds by means of multi-spectral and SAR satellite imagery. A general analysis of ice shelf structures and their temporal changes is performed based on a Landsat mosaic from 1986/90 and a recent TERRA ASTER mosaic from 2001-06. Differential SAR Interferometry (ERS-1/2 tandem and ice phase) was used to derive 2D flow fields for the south-eastern part of the ice shelf and its major tributary glaciers. The flow field of the floating ice is then interpreted in combination with the observed rift patterns in order to evaluate the general stress regime. Hereby, a focus is placed on the grounded areas that typically act as pinning points and thus stabilize the ice shelf. Both the multi-temporal optical imagery as well as a differential interferogram with a long temporal baseline show indications for changes in the dynamics of tributary glaciers. The freeboard height of the floating ice has been evaluated from ICESat surface elevation data from 2003-06. This data

has been analysed with regard to tidal effects, crack formation and the variability of the hinge zone. Furthermore, the freeboard height was used to estimate the ice thickness, which was compared with radio echo and seismic sounding data from the early seventies. The multi-sensor approach provides an unprecedented detailed view of the recent and near-past state of the ice shelf as well as indications for ongoing changes in ice dynamics. The generated data set form a formidable base for future modelling activities.