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Ice flow velocities and elevation change at Fleming Glacier, Wordie Ice Shelf, Antarctic Peninsula

A. Wendt (1), J. Wendt (1), F. Bown (1,2), A. Rivera (1,2,3), R. Zamora (1), C. Bravo (1), and G. Casassa (1)

(1) Centro de Estudios Científicos, Valdivia, Chile (awendt@cecs.cl), (2) Centro de Ingeniería de la Innovación del CECS, Valdivia, Chile , (3) Departamento de Geografía, Universidad de Chile, Santiago, Chile

Glaciers in the Antarctic Peninsula have been responding to the pronounced atmospheric warming in the region (Vaughan et al. 2003) with frontal retreat (Cook et al. 2005), ice shelf collapse (Rott et al. 1996) and ice flow acceleration and thinning (Rignot et al. 2004; Shepherd et al. 2003; Pritchard & Vaughan 2007). These trends have progressively migrated southwards along the Antarctic Peninsula causing, for instance, a substantial retreat of Wilkins Ice Shelf (70.2˚S) in 2008. At 69.3˚S, but 300 km to the east, Wordie Ice Shelf experienced a major reduction in size in the 1980s (Doake & Vaughan 1991). Available information about this ice shelf and its feeding glaciers dates back to the 1970s when ice thickness and velocity measurements were carried out on Fleming Glacier (Doake 1975). Although initially it was thought that the post-collapse conditions of the feeding glaciers remained unchanged (Vaughan 1993), more recent evidence shows that glaciers accelerated after the ice shelf collapse and substantial glacier thinning has occurred (Rignot et al. 2005).

We present data acquired during two field expeditions to Fleming Glacier. During the first season in November 2007, we installed an Automatic Weather Station (AWS) and a permanent GPS site. Additional data including a local GPS network, ground penetrating radar measurements and snow densities were collected. In December 2008, during the second field campaign, surface elevation data were acquired using an airborne laser scanner along a trajectory between Gibbs Glacier and Airy Glacier, along the ice divide between both sides of the Peninsula and on Fleming Glacier.

The AWS was found protruding only 20 cm above the snow surface, demonstrating the high snow accumulation in the area, which was sufficient to cover the 4 m high tower installed in 2007 and that annual variability in the mass accumulation is significant. The station collected data for 250 days. The permanent GPS stopped collecting data after 75 days due to the burial of the solar panels.

The field data have been complemented by a remote sensing analysis using optical (ASTER, Landsat, ICESat) and radar data (ERS, Envisat). An update of the area cover of Wordie Ice Shelf after the collapse in the 1980s yielded a further reduction of 750 km^2 between 1989 and 2008, resulting in an almost complete removal of the ice shelf. Recent data of surface topography and the dynamics of the glaciers draining into Wordie Bay will be compared with previous data to investigate the response of the glaciers in the light of recent climate warming in the region.