



Primer Congreso de Oceanografía Física, Meteorología y Clima
Auditorio EMPREUDEC, Universidad de Concepción, Concepción, Chile
30 Septiembre – 02 de Octubre de 2009

Antarctic peninsula recent cryospheric changes in response to atmospheric and oceanic warming

Francisca Bown^{1,2*}, Andrés Rivera^{1,2,3}, Anja Wendt¹, Gino Casassa¹ & Jorge Carrasco⁴

¹Centro de Estudios Científicos (CECS), Av. Arturo Prat 514, Valdivia, Chile.

²Centro de Ingeniería de la Innovación del CECS, Av. Arturo Prat 514, Valdivia, Chile.

³Universidad de Chile, Portugal 84, Santiago, Chile.

⁴Dirección Meteorológica de Chile, Av. Portales 3450, Santiago, Chile.

*Corresponding author: fbown@cecs.cl

Glaciers and ice-shelves along the Antarctic Peninsula exhibit complex interaction mechanisms in response to the ongoing climatic warming. Air temperatures have largely increased in the region, and several ice shelves e.g. Larsen A, Larsen B, Wordie, Wilkins, have retreated gradually over the past three decades but in some cases, large portions of floating ice were observed to collapse during sudden events. Melt-water production at the surface, due to atmospheric warming, has also proven to drive ice crevassing which further on, enhances the break-up of ice-shelves (Scambos *et al.*, 2000), whilst basal melt is estimated to increase in direct relationship to ocean warming (Holland & Jenkins, 2008). Due to the loss of their buttressing force, glaciers flowing into these ice-shelves remnants have consequently responded with ice flow acceleration and thinning (Rignot *et al.*, 2004), however at the upper reaches of several of them, an increase in snow accumulation has been detected recently. Therefore, among the main questions arising from the combination of such processes are i) whether the glaciers can reach a new equilibrium with climate, ii) what are the current glacier mass balances or iii) are the increases in snow accumulation able or not to compensate for the ice acceleration and thinning. One interesting case of study in the western side of the Antarctic Peninsula is the Fleming glacier (69°S), where several geophysical, remotely-sensed and ground techniques have been used to survey and better understand glacier/ice shelf interactions in the Wordie embayment. The used methods included among others, airborne radar and lidar-mapping system for detection of ice thicknesses, surface topography and ice elevation changes; satellite passive and active image analysis for determination of glacier and ice-shelves areal and dynamic changes in recent decades; and surface climatology measurements through the deployment of Automatic Weather Stations (AWS) combined with GPR survey to infer snow accumulation. This work has the aim of improving our knowledge of glaciological changes in the western side of the Antarctic Peninsula, analysing in detail the role of the atmosphere, and the implications for global sea-level rise. This paper is presenting the most updated results obtained with the above methods. The collected data confirm the dynamic response of the glacier to the removal of Wordie ice shelf, process that has already lasted for more than 20 years. This dynamic response is characterized by ice thinning in the order of 1 to 2 m/year observed several tens of kms upstream the present grounding line, and ice acceleration in the order of 50% when comparing present velocities with data collected in the in mid 1970s (Wendt *et al.*, submitted).

References

Holland, P. R. & A. Jenkins. 2008. The response of Ice Shelf Basal Melting to variations in Ocean Temperature. *Journal of Climate*, 21, 2558–2572.

Rignot, E., G. Casassa, P. Gogineni, W. Krabill, A. Rivera and R. Thomas. 2004. Accelerated ice discharge from the Antarctic Peninsula following the collapse of Larsen B iceshelf. *Geophysical Research Letters*, 31(18), L18401.

Scambos, T., C. Hulbe, M. Fahnestock & J. Bohlander. 2000. The link between climate warming and break-up of ice shelves in the Antarctic Peninsula. *Journal of Glaciology*, 46(154), 516–530.

Wendt, J., A. Rivera, F. Bown, A. Wendt, R. Zamora, G. Casassa and C. Bravo (submitted). Recent ice elevation changes of Fleming Glacier in response to the removal of Wordie ice shelf, Antarctic Peninsula. *Annals of Glaciology*.