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Two repeat crossings of Drake Passage in austral summer 2006: short term variations and evidence for considerable ventilation of intermediate and deep waters.

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A high-resolution, full-depth, hydrographic section across Drake Passage with tracers and horizontal velocity measurements was repeated within three weeks in austral summer 2006. In-situ data (temperature, salinity, dissolved-oxygen, horizontal current velocities) are used to determine the location of the fronts and eddies of the Antarctic Circumpolar Current (ACC) inferred from 7-day composite dynamic topography maps along the transect. Frontal displacements within here weeks are about 40 km (2 stations) along the section. Considerable differences in properties between the two sections are observed throughout the whole water column with values as high as 0.2°C in temperature, 0.01 in salinity, 0.03 kg.m-3 in neutral density and 10 μmol.kg-1 in dissolved-oxygen concentration found below a depth of 3000 m. Only part of the differences is attributable to frontal or eddy displacements along the section. The other part results from the spatial heterogeneity of water properties upstream the section and the funnelling of the flow due to the topographic constraints of the Shackleton Fracture Zone (SFZ). Therefore, the considerable short-term differences in water properties in rather large-scale structures that cannot be accounted for by frontal motions along the section, call for caution when interpreting differences in hydrographical properties from cruises that are years apart in terms of climatic signals.
The two sections show efficient ventilation of Antarctic Intermediate Water (AAIW) by Winter Water (WW) in the Yaghan Basin, with an estimated eddy-enhanced subduction rate of over 170 m.year-1. The SFZ constitutes a barrier, causing the two SACCF branches to separate by about 400 km and creating sheltered conditions in partial isolation from the ACC, while promoting an active recirculation region in the Ona Basin. This active recirculation, marked by cyclonic eddies carrying cold, fresh and oxygenated water from south of the Southern Boundary of the ACC, causes effective ventilation of the whole Circumpolar Deep Water (CDW) density range.