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Planetary wave vacillations and storms in the Southern Hemisphere

M. Baldi (1,2) and G.A. Dalu (1,2)

(1) Niwa, Auckland, New Zealand, (2) Permanet affiliation: Institute of Biometeorology, Ibimet-CNR, Rome, Italy

The planetary flow in the Southern Hemisphere (SH) is more zonally symmetric than the corresponding flow in the Northern Hemisphere (NH). In the upper troposphere, the wind is largest in the subtropical jet at 30°S stretching across Australia, and in the mid-latitude jet across the South Atlantic and Indian Ocean at 50°S. The sub-tropical jet weakens in the mid-troposphere, and it is absent in the lower troposphere. In the lower troposphere the annual average westerly wind is confined in a relatively narrow latitudinal band around 50°S (Lorenz and Hartmann, 2001). The zonal symmetric mode (ZW0) dominates the seasonal variance. The mode zero is modulated by two standing modes ZW1 and ZW3, which are excited by the continental topographic features and by the heat diabatic fluxes related to the SST gradients and to seasonal sea-land thermal contrast. Even if these modes are relatively weak (van Loon and Jenne, 1972, Hobbs and Raphael, 2007), they are important, since they dominate the seasonal zonal asymmetry of the planetary flow (van Loon and Jenne, 1972), with significant links with El Niño/La Niña southern oscillation (Trenberth, 1980; Renwick and Revell, 1999; Raphael, 2003). Analysis study has shown that mode ZW1 and ZW3 can exhibit chaotic like behaviour (Kidson, 1988, 1999). Vacillations of these modes with a quasi-periodicity of the order of 40 days can occur in regions of strong zonal wind because of non-linear wave-wave interaction (De Gregorio and Dalu, 1984). The onset of these vacillations can be triggered by the arrival of a higher order travelling wave in a region of strong zonal wind. In addition, the presence of these higher order modes shortens the time scale of the vacillations of mode ZW1 and ZW3. Finally an attempt is made to relate these vacillations to the diversion of the Antarctic storms towards the ANZ region.