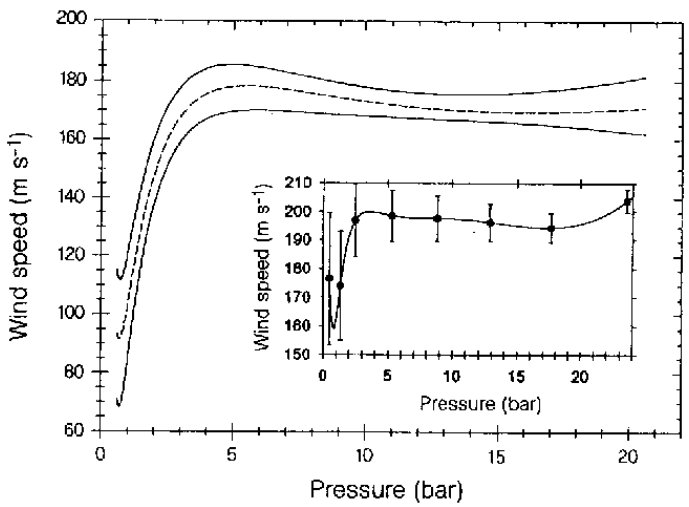

Figure 1 The Doppler wind measurements (main figure) now incorporate a number of significant changes from the preliminary results of Atkinson *et al.*[1] (inset). The new wind speeds were calculated using the probe descent velocity profile obtained from measurements of pressure and temperature by the Atmospheric Structure Instrument, the assumption of hydrostatic equilibrium, and the equation of state. Descent velocities are now modelled to better than 5% (~1–5 m s^{-1}) throughout the descent, and the probe entry and initial descent longitude is known to ±0.21° (3σ). Periodic null frequency measurements are thought to be caused by imperfections in the relative timing of the relay receiver hardware and orbiter clocks. When unaccounted for, the timing mismatch between the relay receiver hardware and the orbiter ultrastable oscillator (USO) causes periodic discontinuities of ~7 Hz in the measured frequencies. Our treatment of the timing errors involves averaging through, as opposed to complete removal of, the discontinuities, resulting in a net reduction of the frequency residuals by ~50 Hz and a subsequent decrease in the retrieved deep zonal winds of 30 m s^{-1}. The probe USO, qualification-tested to 60 °C and acceptance-tested to 50 °C, in fact experienced temperatures nearing 150 °C at the end of probe transmission. Thermal tests at NASA Ames Research Center on several flight spare USOs have recently concluded; the high-temperature behaviour of the USOs has been characterized and incorporated into the probe oscillator frequency model. The error envelope (solid lines) of wind speeds is based on worst-case descent velocity variations (±5%), probe longitude error (±0.21°, 3σ) and USO thermal response corrections (none/maximum).

Fig 1 of Atkinson et al. 1997, NATURE, 388, p649