An exceptionally high-resolution ice core record of climate variability from the Whitehall Glacier Ice Divide is presented for the 50 year time period from the 1957 International Geophysical Year to 2007. This site is located at the northern margin of the Ross Sea, only 12 km from open ocean. Due to its proximity to the Circumpolar Trough, low pressure centres bring regular precipitation, resulting in more than 2 m of accumulation per year. The core was processed on a continuous melter system at the N.Z. Ice Core Facility, and a total of 3,000 samples were analysed for stable isotope ratios ($\delta^{18}O$ and $\delta^{18}D$). This results in an average resolution of 60 samples per year, enabling a precise age model to be developed. Isotope data demonstrate a strong correlation with temperature recorded at a nearby weather station at Cape Hallett ($R^2=0.72$) and snow pit (icp-oes) elemental chemistry exhibits peaks that are concurrent with high wind speeds at Cape Hallett, suggesting that synoptic-scale low pressure centres are a dominant control on snow delivery. In addition, the deuterium excess record shows two sharp transitions of ~5 per mil occurring around 1980 and 1994, and the winter-summer stable isotope (temperature) amplitude is reduced between these transitions. These shifts reflect abrupt changes in atmospheric circulation and we use back trajectory analyses to distinguish characteristic storm tracks for moisture-bearing cyclones in this region. These circulation patterns are strongly influenced by decadal-scale atmospheric forcings, particularly the El Nino Southern Oscillation and the Southern Annular Mode.