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Atmospheric drivers of a 4-month drift of an ice buoy in the Antarctic marginal ice zone

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Sea-ice drift in the Antarctic marginal ice zone (MIZ) was investigated by using an ice buoy (buoy U1), deployed during the winter sea-ice expansion in July 2017, and drifted for approximately four months from the South Atlantic sector to the Indian Ocean sector of the Southern Ocean. The analysis of this buoy revealed that it remained within the MIZ even during the winter ice expansion, as the mixed pancake-frazil field was maintained. This allowed for a continued assumption of free drift conditions for buoy U1's full drift, where it continued to respond linearly to the momentum transfer from surface winds. The analysis of buoy U1 also indicated a strong inertial signature at a period of 13.47 hours however, the wavelet analysis indicated majority of the power remained within the lower frequencies. This strong influence at the lower (multi-day) frequencies has therefore been identified as the primary effect of atmospheric forcing. When these lower frequencies were filtered out using the Butterworth high-pass filter it allowed the inertial oscillations to become more significant within the wavelet power spectrum, where it can be seen that these inertial oscillations were often triggered by the passage of cyclones. The initiation of inertial oscillations of sea ice has therefore been identified as the secondary effect of atmospheric forcing, which dominates ice drift at sub-daily timescales and results in the deviation of ice drift from a straight-line path. This comprehensive analysis suggests that the general concentration-based definition of the MIZ is not enough to describe the sea-ice cover, and that the MIZ, where sea ice is in free drift and under the influence of cyclone induced inertial motion, and presumably waves, extends up to »200 km.