The Southern Ocean is a remote area, with the overlying atmosphere being unique and largely ignored by the meteorology community. There is a growing body of evidence that suggests the clouds over the Southern Ocean are poorly understood, and poorly represented in climate models. The focus of this study is on the structure and dynamics of the boundary layer.

Sounding data from Macquarie Island were analysed to determine the thermodynamic structure of the boundary layer, and statistics for cloud amount, cloud vertical structure and wind shear at cloud interfaces. The mean and variance of a number of thermodynamic variables was computed and compared to ECMWF ERA-Interim re-analysis data. ERA underestimated temperature over all levels by upto 3 degrees, compared to the soundings, and significantly underestimates wind shear over all levels.

Cloud fields were analysed, and it was found Macquarie Island is dominated by low altitude clouds, and ERA suggests the clouds occur more frequently and at a higher altitude than the soundings. Wind shear at cloud interfaces was quantified, and it was found that the greatest wind shear occurs over cloud base, rather than cloud top, as one would expect. This result was reflected in ERA re-analysis data, however the magnitude of the wind shear was less than Macquarie Island soundings. These results indicate that the thermodynamic structure of boundary layer clouds over the Southern Ocean is unlike the typical thermodynamic structure of boundary layer clouds.