The objective of this thesis is to introduce the theory of Lagrangian coherent structures (LCSs) and analyze LCSs on atmospheric data. Specifically, the focus is on the stratospheric winter polar circulation on the Northern Hemisphere. Computations were performed using the Python programming language with the main obstacle of the computations being singularity at the North Pole. The time period studied was December 2007 to February 2008. Hyperbolic LCSs were calculated for this specific time frame and subsequently studied and analysed. Three main events in the evolution of the polar vortex were described: the formation, the stabilisation and the collapse of the vortex.