One of the main goals of the Concordiasi campaign was to improve satellite data assimilation at high latitudes, and in particular, the assimilation of the Infrared Atmospheric Sounding Interferometer (IASI) data over the southern polar region. This study focuses on the retrieval of IASI data using a one-dimensional variational data assimilation (1D-Var) system, which was carried out at the Concordia station and within the framework of Concordiasi. The study period lasted from the 20th of November until the 12th of December 2009. Radiosonde measurements are utilized to validate temperature and water vapor retrieved profiles. Baseline Surface Radiation Network (BSRN) data and manned measurements in Concordia are used to verify skin temperature retrievals and to derive information about cloudy conditions. This study assesses the impact of several parameters on the quality of the retrieved profiles. In particular, the background error specification is crucial. The background error covariance matrix is optimally tuned to provide the best possible retrievals, computing and maximizing the Degrees of Freedom for Signal (DFS). The DFS characterizes how the assimilation system uses the observation to pull the signal from the background. Thus, for the period of study, the retrieved profiles of humidity and of temperature are optimally improved compared with background profiles, with the largest reduction in error for the skin temperature.