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Ozone profile observations at Sodankylä, Finland

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Ozone profile observations have been made at Sodankylä (67.4° N, 26.6° E) since 1989 on regular basis using ECC type of sondes. During 15 year period (1989-2003) 1168 ozone sonde launches have been performed that have sufficient data quality in the stratosphere. Best data coverage is for the winter/springtime period associated with different stratospheric campaign activities. This coincides with the period of high dynamical variability and also with the period of vortex ozone depletion. The data show winter/springtime decrease of stratospheric ozone over the nineties and corresponding cooling of the lower stratosphere. On the other hand in the troposphere and lowermost stratosphere we observe increase of ozone. This observed ozone increase in troposphere is statistically significant regardless of selection of ending year of the data series. In order to explain observed variability we constructed a multiple regression model. The model includes dynamical proxies as calculated from the new meteorological data set ECMWF ERA-40. We find that proxies accounting for vortex ozone depletion, diabatic circulation and tropopause altitude explain from 50 to 80 percent of the variability in winter/springtime stratospheric ozone profiles in the altitude range of 100 to 10 hPa. An increase of ozone in the lowermost stratosphere during the whole period of observations correlates highly with changes in the tropopause altitude. This study also includes a thorough data quality assessment and data series homogenization. Since the database includes both SPC and EN-SCI type ozone sondes it was necessary to investigate differences between two sonde types. The difference profiles were obtained from a series of dual and multiple ozone sonde flights performed in Sodankylä between May 2003 and July 2004. The results of our field experiment show agreement with earlier laboratory tests and thus confirm the use of 0.5 % KI solution in case of EN-SCI sondes, while standard solution of 1 % KI gives the best results for SPC sensors when comparing total ozone retrievals with local Brewer spectrophotometer column ozone measurements. Secondly, data from ozone sonde comparison flights could be used to establish a correction algorithm that can be applied to those

EN-SCI sonde profiles that have used standard solution, a common problem in ozone sonde networks. It is suggested that our results in combination with other field experiments and laboratory tests could be used to provide a tool to adjust inhomogeneities in the data record that are related to the use of both EN-SCI and SPC type ozone sonde measurements at the same ozone sonde station or sonde network.