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New spectrometers for atmospheric trace gases measurements in two antarctic stations

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The measurements to optically thin (column amounts less than 10ˆ15 molec/cmˆ2) trace gases such as BrO and OClO will make it necessary to substitute the GASCOD spectrometer currently operational at MZS, with an upgraded version having lower detection limits and higher sensor performance. These improvements will make it possible to also detect trace gases which are rapidly photolysed during daylight and which become detectable only at low solar zenith angles (greater than 90°). The installation of new measuring system will require a period of simultaneous measurements by both instruments for an accurate comparison as well as validation tests of the results. The priority is to continue the historical series of ozone and NO2 data (measurements began in 1996) which will allow climatological studies of the trends of the concentrations of these gases in the polar regions. Nitrogen dioxide, in particular, is thought to play an important and still not clearly understood role in climate changes and recent studies (Liley et al., 2000) which reveal that a 5% increase per decade has been at southern mid-latitudes, has emphasized the need for this kind of measurements, particularly from polar regions where it is more difficult to obtain such information. BrO and OClO column amounts do not have such a long time series available due both to the relatively recent discovery of their involvement in atmospheric chemistry and to many still unsolved problems relating to measurement modes and spectral analyses. Finally, the installation of a new DOAS spectrometer capable of taking measurements along different zenith angles at the Dome Concordia Station, will allow us to follow depletion processes even during the phases of extreme impoverishment of the ozone layer directly above the Station. This will be possible due to, amongst other factors,

recent and significant developments which have made in the analysis of spectral data from measurements of diffuse solar radiation. Following initial measurements of diffuse solar radiation at the zenith, in fact, novel techniques will be used to obtain such measurements at different zenith angles, called “off-axis” or “oblique-up view looking”, which will be used to detect thin optical depth stratospheric minor gases in polar regions, even during periods when the ozone depletion is still high (total column less or equal 150-200 DU) and the halogen compounds BrO and OClO are still present in significant concentrations (total column 10ˆ14 molecules cm-2) sufficient to activate ozone destruction processes. Moreover, suitable sets of quasi-simultaneous measurements at different zenith angles will provide the vertical profile of the given gas which will open the way for new fields of study in the vertical distributions of gases which are photochemically active during dawn and sunset. Generally speaking, the “off-axis” method clearly shows the innovative aspects both of this measurement technique and the successive data analysis methods which form the most advanced aspects of this research.