

Eight years of B199 Brewer Umkehr measurements at the Marambio Base, Antarctic Peninsula

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There are various ways to monitor the vertical ozone profiles, including the Umkehr method, which uses the ground-based spectral UV radiation observations. The Umkehr observations can be carried out also in extreme environments, including Antarctica. At the Marambio Base, Antarctic Peninsula Region (64° 14' 27.65" S, 56° 37' 36.31" W), the B199 Brewer spectrophotometer was installed on 14th February 2010. Since then, the Czech Hydrometeorological Institute has been carrying out regular ozone monitoring, including the Umkehr vertical ozone profiles retrieval. The Umkehr profiles have been processed using the method newly proposed by Čížková et al. (2018), which differentiates between the a-priori profiles for depleted and non-depleted ozone layer. At the period between February 2010 and December 2017, in total 1325 B199 Umkehr vertical 16-layer profiles have been retrieved, 41 % of them during the ozone-hole period (September–November). The total ozone column in the days with Umkehr ozone profiles fluctuated between 382.2 DU and 135.7 DU with the mean amount of 258.8 DU. The ozone maxima were observed in Umkehr layer 5, situated in the altitude of approximately 20–25 km above surface (the mean amount of ozone in this layer was 60.7 DU, i.e. 23.5 % of the total ozone amount). However, the most ozone depletion was occurring in Umkehr layer 4 (15–20 km above surface), where the ozone amounts ranged between 81.8 DU and only 3.9 DU with the mean value of 41.7 DU. During the ozone-hole period, the ozone variability in the altitudes to about 30 km above the surface was greater than in the rest of the year, being affected by the frequent alterations of ozone-poor air masses from the polar vortex and the ozone-richer air from the subpolar regions. The signs of ozone depletion were usually visible already in mid-August, when the ozone amount in the altitudes of 20–30 km above surface was significantly lower than in the non-depleted period. In September, the ozone depletion was already more pronounced even in the lower altitudes, especially between 15 and 20 km above surface. The ozone in the upper altitudes healed earlier than in the lower latitudes, where the depletion often persisted till late November. However, due to various chemical and dynamical factors, the progress of the ozone-hole development over the Marambio Base development differed from season to season. For example, in the season 2013–2014, the onset of the ozone hole was very early, but the ozone layer already healed in late October. On the other hand, in the season 2015–2016, the ozone-hole became evident only in September, but with some fluctuations it lasted till late November.

Key words: ozone, stratosphere, Umkehr, Brewer spectrophotometer, Antarctica

References

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