

50 Years of Routine Ozone Soundings at Hohenpeissenberg

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After one or two years of testing, regular balloon-soundings with Brewer-Mast ozone sondes started at Hohenpeissenberg on November 2nd, 1966. Initially, launch frequency was one sounding per week, early in the morning on Wednesdays. From 1978, launch frequency was increased to three per week in winter (Monday, Wednesday, Friday, November to April), and to two per week in summer (Monday and Wednesday, May to October).

From the beginning, comprehensive sonde preparation and quality assurance was performed. Preparation has always included thorough cleaning of disassembled pumps, hoses, plexi-glass bubblers, silver anodes and platinum cathodes (Claude et al., 1987). New and re-used sondes are subjected to the same cleaning procedure.

All Hohenpeissenberg ozone soundings are scaled to match the more precise total ozone measured by Dobson or Brewer-Spectrophotometers, or satellites (Attmannspacher and Dütsch 1971). Apart from an apparent step in 1974 from ≈ 1.14 to ≈ 1.09 (for which we have no explanation), and steps at the time of major radiosonde changes (from VIZ to Vaisala RS80 in 1994/95 and to Vaisala RS92 in 2004/05, Steinbrecht et al., 1999, 2008), the Dobson correction factors have been more or less stable. This suggests no major changes in Brewer-Mast performance since 1974 at Hohenpeissenberg.

The long-term record clearly shows decline of ozone in the lower stratosphere by $\approx 15\%$ from 1967 to the mid-1990s. Since the mid-1990s, ozone has leveled off and even increased slightly (up to 5%) – a demonstration of the success of the Montreal protocol. Tropospheric ozone, on the other hand, has increased substantially from 1967 until the late 1980s, by 30% or more. Since 1990, tropospheric ozone has leveled off, consistent with the general evolution of precursors. The tropospheric ozone record indicates the success of political measures limiting Volatile Organic Compounds and NO_x emissions (catalytic converters, cleaning up of power plants, . . .), but also the effects of the breakdown of Eastern European economies after 1989. A suspicious tropospheric maximum around 1987 is not seen in other records (e.g. near the ground).

Because we have no explanation for this excessive maximum, or other peculiarities like the jump in correction factors in 1974, we have not attempted to apply time-varying corrections to the Brewer-Mast ozone data per se. It is however, planned to better correct the entire record for radiosonde changes, and for (systematic) variations in pump temperature and pump efficiency (Steinbrecht et al., 1996). This re-corrected record will hopefully become available after the Vaisala RS92 to RS41 transition planned for 2017.

References:

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