



A new miniature balloon-borne optical sensor for the measurement of ozone and other stratospheric trace gases

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We developed a light-weight balloon-borne sonde (PIOS: platform independent optical sensor) for the simultaneous measurement of trace gas profiles in the stratosphere. Its measuring principle is based on the detection of sunlight intensity with a miniature spectrometer. The wide spectral coverage of the miniature spectrometer (200 - 850 nm) offers the possibility for measurements of trace gases which absorb within this wavelength range, e.g. O₃, NO₂, and BrO. The new sensor can be operated anywhere in the world due to the low weight of the payload (1.7 kg) and the autonomous portable telemetry system. This and the moderate price make it a very versatile tool for satellite validation and for case studies, which require a high number of launches. The sonde does not need temperature stabilisation, although the spectrometer experiences temperature changes of approx. 15 K (inside a polystyrene box) during the ascent. Inflight corrections were applied, which compensate the effects of temperature changes. In a first demonstration of its performance ozone profiles were retrieved from the irradiance measurements with an adapted Dobson-spectrometer algorithm. The comparison of the determined ozone profiles with profiles measured by ECC sondes and LIDAR shows good agreement within 10% and 20% for altitudes between 15 km and the burst point of the balloon (≈ 37 km). Due to the low weight and the modular design, PIOS can be operated on board other platforms. For example, PIOS on board a high-altitude UAV would allow measurements at exactly determined positions and furthermore, the same PIOS instrument could be used for several missions. Actually, the PIOS design is adapted to a rocket-borne version.