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Evaluation of ozonesondes, HALOE, SAGE II and III, Odin-OSIRIS and SMR, and ENVISAT-GOMOS, -SCIAMACHY and -MIPAS o_3 profiles in the tropics from SAOZ long duration balloon measurements

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Within the HIBISCUS project, long series of ozone profiles between 10 and 25 km have been obtained at almost constant latitude (20˚S) in the tropics by remote sensing from circumnavigating IR Montgolfier (MIR) long duration balloons in February–March 2003 and 2004. The performances of practically all satellite instruments available in the tropics and also ozonesondes have been investigated by comparison with this data set. Thus, systematic positive or negative altitude shifts could be observed in satellite profiles, varying from $<$50 m for the GOMOS stellar occultation instrument, followed by +100/200 m for solar occultation systems (SAGE II, HALOE above 22 km), but as large as –900 m or +2000 m for limb viewing systems (OSIRIS, SCIAMACHY). The ozone relative biases are generally limited, between –4 % and +4 %, for measurements in the visible Chappuis bands (SAGE II and III, GOMOS above 22 km and OSIRIS), the near IR (HALOE above 22 km) and the ozonesondes, but increase to –7 % in the UV (SCIAMACHY), and +7 % in the mid-IR (MIPAS) and the submillimetric range (ODIN-SMR). Regarding precision, evaluated statistically from the zonal variability of ozone concentration, the best measurements are found to be those of SAGE II (2 %), followed by HALOE above 22 km (3-4 %), then the ozonesondes, SAGE III moon and OSIRIS ($\sim$5%), GOMOS above 22 km and SCIAMACHY ($\sim$6 %), MIPAS (8.5 %) and finally SMR (16 %). Overall, all satellite ozone measurements appear little reliable in the tropical troposphere except those of SAGE II (and eventually SAGE III), though low biased by 50 % and of limited (50 %) precision.