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FLASH-B Lyman-alpha hygrosonde for UT/LS: instrument design, observations and comparison.

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Lyman-alpha FLASH-B (FLuorescent Advanced Stratospheric Hygrometer) is an open cell balloon-borne instrument developed at Central Aerological Observatory, Russia for in situ water vapour observations in the UT/LS. The instrument is based on fluorescent method which implies H2O molecule photodissociation when exposed to radiation at a wavelength lambda=121.6 nm (L-alpha - hydrogen emission). The excited OH radical produced fluoresces within 308 - 316 nm wavelength range. The detector of OH fluorescence is a Hamamatsu photomultiplier run in photon counting mode. Thus, the intensity of the fluorescent light as well as the instrument readings is directly proportional to the water vapour mixing ratio under stratospheric conditions. FLASH-B is a light-weight (0.980 kg) and small size (150mm x 200mm x 350mm) instrument with estimated total uncertainty 9%. During LAUTLOS-WAVVAP field campaign (January-February 2004, Sodankyla, Finland) FLASH-B was flown together with NOAA/CMDL frostpoint hygrometer. A number of simultaneous water vapour measurements allowed a direct comparison of these two sensors in the stratosphere and upper troposphere. The comparison reveals excellent agreement between the hygrosondes; with the exception of instrumental artifacts the mean difference is 2.6 +/- 3.1% (1s) in the stratosphere. Furthermore, fine structures in the water vapour profile at the edge of polar vortex are captured well by both instruments. Also presented here are the results of simultaneous water vapour soundings by FLASH-B, Snow White, CFH and polymer sensors during November-December 2005 above Lindenberg, Ger-

many and Sodankyla (Finland). The reliable and reproducible results acquired using FLASH-B instrument provide a valuable dataset for the validation of model and satellite data. The comparison of H2O profiles retrieved during LAUTLOS campaign with the results of model simulations made by applying trajectory model to ECMWF humidity fields shows model dry bias of about 1 ppmv in the lower stratosphere above 400 K. During winter 2004/05 FLASH-B has been flown from Ny-Alesund (79 N, 12 E). The water vapour profiles obtained in the presence of ice PSC show the dehydration layers. Airborne version of FLASH hygrometer was operated during APE-GAIA, EUPLEX and TROCCINOX field campaigns for UT/LS water vapour observations onboard high altitude M55 “Geophysica” aircraft. Aircraft and balloon versions of FLASH are used in SCOUT-O3 project. This work has been partly supported by INTAS YSF 05-109-4955 grant.