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Comparison of measured and modelled downwelling Longwave Infrared Radiation at Payerne, Switzerland

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In this study, a comparison of measured and modelled downwelling Longwave Infrared Radiation (LIR) in Payerne, Switzerland, was performed. The comparison was carried out in the frame of the Longwave Infrared Radiative forcing trend Assimilation over Switzerland (LIRAS) – project. The LIRAS project aims to investigate LIR in Switzerland and to produce trend estimates of LIR using observation data, statistical tools and radiative transfer models. Particular attention in the project is paid to the main atmospheric window (8 – 14 μm), where most of the changes in downwelling LIR take place.

LIR measurements in Payerne/Switzerland (Lat. 46.49° N, Long. 6.57° E, Alt. 490 masl) were provided by a broadband Kipp & Zonen CG4 pyrgeometer and a modified Kipp & Zonen CGR3 pyrgeometer sensitive only in the atmospheric window. The model calculations were accomplished with the radiative transfer models SBDART (Ricchiazzi et al, 1998) and MODTRAN v4.0 (Berk et al., 2000) for a wavelength range of 3 – 100 μm and 8 - 14 μm.

Eight clear nights in summer 2007 were selected using the Automatic Partial Cloud Amount Detection Algorithm (APCADA) developed by Dürr (2004). Vertical profiles of pressure, temperature and relative humidity, measured by radiosondes launched at 2300 UTC in Payerne, were incorporated into the models. The concentrations and profiles of other greenhouse gases were deduced from various sources. For CO_2, the last IPCC value of 379 ppm was taken, whereas the total column of ozone was supplied

from the Aura spacecraft of NASA. For all other trace gases, midlatitude summer atmospheric profiles provided by Anderson et al. (1986) were applied. The rural type of the aerosol model by Shettle (1989) was used in all calculations to account for the aerosol effects. To compare measurements and computations of LIR, the measurements were averaged from 2300 UTC to 2330 UTC to coincide with the computed LIR based on radiosondes launched at 2300 UTC.

Results revealed that differences between measured and modelled LIR for the selected nights, using SBDART, were between -1.1 and +2.2 W $m^{-2}$for the broadband range and between -1.8 and +1.1 W m^{-2}in the atmospheric window. Using MODTRAN, the differences between measured and modelled LIR were between -3.4 and -9.2 W $m^{-2}$for the broadband range and between -2.8 and -8.9 W m^{-2} in the atmospheric window.

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