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Atmospheric Measurement Techniques Discussions

Interactive comment on "The Austrian radiation monitoring network ARAD – best practice and added value" *by* M. Olefs et al.

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The Austrian radiation monitoring network ARAD – best practice and added value by M. Olefs, D. J. Baumgartner, F. Obleitner, C. Bichler, U. Foelsche, H. Pietsch, H. E. Rieder, P. Weihs, F. Geyer, T. Haiden, and W. Schöner

Abstract The Austrian RADiation monitoring network (ARAD) has been established to advance the national climate monitoring and to support satellite retrieval, atmospheric modelling and solar energy techniques development. Measurements cover the downwelling solar and thermal infrared radiation using instruments according to Baseline Surface Radiation Network (BSRN) standards. A unique feature of ARAD is its vertical

dimension of five stations, covering an air column between about 200 ma.s.l. (Vienna) and 3100 ma.s.l. (BSRN site Sonnblick). The paper outlines the aims and scopes of ARAD, its measurement and calibration standards, methods, strategies and station locations. ARAD network operation uses innovative data processing for quality assurance and quality control, applying manual and automated control algorithms. A combined uncertainty estimate for the broadband shortwave radiation fluxes at all five ARAD stations indicates that accuracies range from 1.5 to 23 %. If a directional response error of the pyranometers and the temperature response of the instruments and the data acquisition system (DAQ) is corrected, this expanded uncertainty reduces to 1.4 to 5.2 %. Thus, for large signals (global: 1000 Wm2, diffuse: 500 Wm2) BSRN target accuracies are met or closely met for 70 % of valid measurements at the ARAD stations after this correction. For small signals (50 Wm2), the targets are not achieved as a result of uncertainties associated with the DAQ or the instrument sensitivities. Additional accuracy gains can be achieved in future by additional measurements and corrections. However, for the measurement of direct solar radiation improved instrument accuracy is needed. ARAD could serve as a powerful example for establishing state-of-the-art radiation monitoring at the national level with a multiple-purpose approach. Instrumentation, guidelines and tools (such as the data quality control) developed within ARAD are best practices which could be adopted in other regions, thus saving high development costs.

General comments: This is an important contribution with respect to surface radiation measurements for climate monitoring, satellite calibration, radiation modeling and solar energy techniques. The Austrian radiation monitoring network ARAD is described, its aims and the station network and setup. Instruments and the technologies around are well described in detail including calibration, instrument maintenance and special configuration that are requested for BSRN standards. Operational data processing and quality control, including a detailed evaluation of uncertainty is well described and documented. Data policy and different examples of use of ARAD data are given and discussed. The study serves the national and international climate research community

and is helpful for questions related to solar energy techniques. The paper should be published with minor corrections.

Specific minor comments:

Page 10665: line 3: replace downwelling with downward

Page 10669: line 9: replace downwelling with downward

Remark: “downwelling” is often used for downward longwave radiation, because this expression has been used since many years. However, this is not an appropriate expression and this for several reasons. 1. It is not an English word and has therefore not a clear explanation and meaning. 2. What we are measuring is an irradiance at a well-defined level, in a well-defined direction upward or downward. 3. Physically, thermal infrared or longwave radiation is emitted from the ground and greenhouse gases and clouds in the atmosphere hinder this radiation to a certain extend from going out. However, the net longwave radiation is almost always upward and there is therefore no downwelling radiation. Also, a pyrgeometer that looks up measuring downward longwave irradiance does not receive thermal infrared radiation but is almost always emitting. 4. Thermal infrared is electromagnetic radiation, and this is neither upward nor downward welling, whatever “welling” may mean.

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