RAMI4PILPS: An Intercomparison of Formulations for the Partitioning of Solar Radiation in Land Surface Models

Jean-Luc Widlowski (1), Bernard Pinty (1,2), Marco Clerici (1), Yongjiu Dai (3), Martin De Kauwe (4), Koen De Ridder (5), Abdelaziz Kallel (6), Hideki Kobayashi (7,8), Thomas Lavergne (9), Wenge Ni-Meister (10), Alexander Olchev (11,12), Tristan Quaife (13), Shusen Wang (14), Wenze Yang (10), Yan Yang (14), and Hua Yuan (3)

(1) Global Environment Monitoring Unit, IES, EC Joint Research Centre, TP 272, Ispra, VA 21020, Italy, (2) Global Environment Monitoring Unit, IES, EC Joint Research Centre, TP 272, Ispra, VA 21020, Italy, (2) Earth Observation Directorate, ESA-ESRIN, via Galileo Galilei, Casella Postale 64,00044 Frascati, Italy, (3) School of Geography, Beijing Normal University, Beijing, P. R. China, (4) Centre for Ecology and Hydrology, Crowmarsh Gifford, Wallingford, UK, (5) VITO, Flemish Institute for Technological Research Integrated Environmental Studies, Mol, Belgium, (6) Tartu Observatory, Toravere, Estonia, (7) Department of Environmental Science, Policy and Management, University of California, Berkeley, USA, (8) Japan Agency for Marine-Earth Science and Technology, Yokohama, Japan, (9) Remote Sensing Section, Norwegian Meteorological Institute, Oslo, Norway, (10) Department of Geography, Hunter College of the City University of New York, USA, (11) A.N. Severtsov Institute of Ecology and Evolution of the RAS, Moscow, Russia, (12) Department of Bioclimatology, Buesgen-Institute, Georg-August University, G¨ottingen, Germany, (13) College of Life Sciences, University of Exeter, Penryn, UK, (14) Canada Centre for Remote Sensing, Natural Resources Canada, Ottawa, Canada

Remotely-sensed, multi-annual datasets of shortwave radiative surface fluxes are now available for assimilation into Land Surface Schemes (LSS) of climate and/or numerical weather prediction models. The RAMI4PILPS suite of virtual experiments assesses the accuracy and consistency of the radiative transfer (RT) formulations that provide the magnitudes of absorbed, reflected and transmitted shortwave radiative fluxes in LSSs. RAMI4PILPS evaluates models under perfectly controlled experimental conditions in order to eliminate uncertainties arising from an incomplete or erroneous knowledge of the structural, spectral and illumination related canopy characteristics. More specifically, the shortwave radiation is separated into a visible and near-infrared spectral regions and the quality of the simulated radiative fluxes is evaluated by direct comparison with a 3-D Monte Carle reference model identified during the third phase of the RAdiation transfer Model Intercomparison (RAMI) exercise. The RAMI4PILPS setup thus allows to focus in particular on the numerical accuracy of shortwave radiative transfer formulations and to pinpoint to areas where future model improvements should be focused. The impact of increasing degrees of structural and spectral sub-grid variability on the simulated fluxes is documented and the relevance of any thus emerging biases with respect to gross primary production (GPP) estimates and shortwave radiative forcings due to snow and fire events are investigated.