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Evaluation of various procedure transposing global tilted irradiance to horizontal surface irradiance

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Many transposition models have been proposed in the literature to convert solar irradiance on the horizontal plane to that on a tilted plane requiring that at least two of the three solar components (i.e. global, direct and diffuse) are known. When only global irradiance measurements are available, the conversion from horizontal to tilted planes is still possible but in this case transposition models have to be coupled with decomposition models (i.e. models that predict the direct and diffuse components from the global one). Here, two different approaches have been considered to solve the reverse process, i.e. the conversion from tilted to horizontal: (i) inverse modelling approach and (ii) multi-sensors approach. Because only one tilted plane is involved in the inverse modelling approach, a decomposition model need to be coupled with a transposition model to solve the problem. By contrast, at least two tilted planes being considered in the multi-sensors approach, only a transposition model is required to perform the conversion. Global solar irradiance measurements recorded on the roof of the Royal meteorological institute of Belgium's radiation tower in Uccle were used to evaluate the performance of both approaches. Four pyranometers (one mounted in the horizontal plane and three on inclined surfaces with different tilts and orientations) were involved in the validation exercice. Results are presented for transposition (and decomposition) models of various complexity considering both isotropic and anisotropic formulations for the ground reflection transposition factor.