IRS2012-361
International Radiation Symposium 2012
Dahlem Cube, Berlin, Germany, 06 – 10 August 2012

The annual cycle of total precipitable water vapor derived from different remote sensing techniques: an application to several sites of the Iberian Peninsula

Y.S. Bennouna (1), B. Torres (1), V.E. Cachorro (1), J.P. Ortiz de Galisteo (2), C. Toledano (1), A. Berjón (3), D. Fuertes (1), R. González (1), and A.M. de Frutos (1)

(1) Atmospheric Optics Group (GOA), University of Valladolid, Valladolid, Spain (yasmine@goa.uva.es), (2) Meteorological State Agency of Spain (AEMET), Territorial Delegation of Castilla y León, Valladolid, Spain, (3) Izaña Atmospheric Research Center, Meteorological State Agency of Spain (AEMET), Santa Cruz de Tenerife, Spain

The MODIS (Moderate Resolution Imaging Spectrometer) sensor flown on the Earth Observing System (EOS) Terra and Aqua satellites is well suited for the monitoring of atmospheric components from space. The standard MODIS Level 2 precipitable water product, namely MOD05 and MYD05 for Terra and Aqua respectively, consists of two different datasets of column water-vapor amounts obtained using two independent algorithms using either infrared (IR) or near-infrared (NIR) bands of the instrument. NIR retrievals are available for daytime only at a resolution of 1x1 km2, and IR ones for both night and day, at a resolution of 5x5 km2.

With the aim to evaluate the capabilities of both algorithms, and to complement a previous study on the general assessment of PWV and the characterization of its annual cycle over Iberian Peninsula using different types of ground-based stations, the annual cycle of PWV was derived from 7 years (2002-2008) of MODIS observations over 18 of these sites. In this work, the MODIS IR and NIR annual cycles are analyzed and compared with those of GPS (Global Positioning System) stations, AERONET sunphotometer sites, and radiosoundings of the national meteorological services. Here, we focus on the quantification of the differences between the datasets, taking into account that they are derived from different techniques. In addition to the monthly mean analysis, a short validation of MODIS PWV instantaneous estimates is also presented, based on all available GPS PWV data, averaged for a 1-hour window centered on the MODIS overpass time.

All annual cycles present the typical shape with low values in the winter (minimum $\sim$1 cm) and high values in the summer (maximum $\sim$3 cm), drier values and weaker cycles at continental sites as compared to coastal sites. The satellite results clearly depict the north-south gradient, as well as singular patterns such as the local minimum of July characterizing the most southern stations. The differences in the monthly means with respect to ground observations mostly correspond to underestimations, ranging between a few percent to 40%, being generally largest in winter than in summer. Overall, the NIR algorithm performs better than the IR one, especially in the winter time. However, NIR presents overestimations in summer that can reach up to 30%. The comparison results of the annual cycle appear much more heterogeneous within coastal than continental areas, in particular for the Mediterranean region. It was found that the performance of NIR results is strongly influenced by the seasonal variations. This dependence is also observed in IR results but to a much weaker extent. The overpass validation shows that best MODIS/GPS agreement is found for continental sites (rms$\sim$0.3). A large regression bias (0.2-0.3) is found at some coastal sites.

Financial support from the Spanish MICINN (projects of ref. CGL2008-05939-CO3-01/CLI and CGL2009-09740 and “Acción Complementaria” CGL2011-13085-E) are gratefully acknowledged.