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Aerosol and cloud relations and weekly cycles over Central Europe

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In this work, the aerosol and cloud relationships and weekly cycle patterns over Central Europe are examined using level-2 aerosol data from the TERRA MODIS satellite instrument to compile a decadal (2000-2010) 0.1 x 0.1 degree resolution gridded dataset as well as and total cloud cover (TCC) TERRA MODIS data and coarser resolution ISCCP TCC data. Aerosols and TCC were found to be positively correlated for all seasons, the slope of the correlation being slightly higher for low AOD values. A co-examination of AOD, TCC and NCAR/NCEP sea level pressure shows that the positive AOD-TCC correlation holds separately in all pressure bins, thus indicating that the correlation is not a synoptic artefact. A study of the weekly cycle of AOD shows that the main part of the positive (i.e. with midweek peak) weekly cycle plume extends over the central part of Central Europe, with the weekly cycle index (WCI) levels gradually decreasing until the weekly cycle becomes negative (i.e. with weekend peak) when moving away. No clear connection between the WCI patterns and topography was found while there is an apparent correlation between positive weekly cycles in summer and population density. A clear Monday minimum appears over regions with high positive WCI. Monday shifts to Tuesday when moving to the East, indicating aerosol transport from the dominating westerly wind flow. The WCI values and the average percent departures (APDs) for the day of weekly maximum and minimum were examined for 22 selected stations from previous ground-based weekly cycle studies. The weekly cycle is positive and statistically significant for only a few stations situated in France, Germany, Czech Republic and Belgium. A comparison with 1 x 1 degree level-3 MODIS TERRA data shows that in most cases level-3 data can give an indication of the local aerosol weekly cycle strength and phase. The satellite derived day of the weekly maximum and minimum is, generally, in line with results from ground-based studies. The seasonal examination of the WCI patterns show that the positive signal over Central Europe is strongest during summer. More interestingly, the amplitude and phasing of the AOD weekly variability agrees with the TCC one, both for MODIS and ISCCP.