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Relationship between lightning activity and tropospheric water vapor variability over Greece

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Water vapor (WV) is one of the gases that exerts major greenhouse forcing in the atmosphere and due to the associated radiative forcing plays a crucial role in the energy budget of both short and long time scales. In particular, the upper tropospheric partition of the WV has a more prolonged residence time in the atmosphere since it is less involved in condensation-precipitation processes that take place in its mid latitude lower tropospheric counterpart (>600mb). In convective environments, the upward WV transport can be considered the dynamical result of the vertical cloud growth. Another discrete characteristic of convection is lightning. The strong updrafts, vertical mixing and various complex ice processes lead to the subsequent charge separation, further leading to the dielectric air breakdown and lightning discharge.

The hypothesis we herein test is whether the electrified clouds are the major contributors of the upper tropospheric WV content. The observational tools employed are the Meteosat Second Generation (MSG) via the Spinning Enhanced Visible and Infrared Imager (SEVIRI) and the Lightning Mapping Array (LMA) operated by Hellenic National Meteorological Agency, from which routinely retrievals of tropospheric WV and lightning activity characteristics are available. Target case studies over the Greek peninsula (LMA has the maximum detection efficiency) where convective regime is dominant will be isolated and studied for the years 2008 and onwards. The basis of these comparisons will include the temporal evolution of upper tropospheric WV where lightning is present or absent (or less than an empirical threshold).