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Demonstration of water vapor and Isotopes measurement from lidar using a multi-platform, multi-instrumental approach

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The Lidar Emitter and Multispecies greenhouse gases Observation iNstrument (LEMON) objective is the development and test of a new Differential Absorption Lidar (DIAL) sensor concept for greenhouse gases and water vapor for spaceborne, airborne or ground-based measurements. The innovative instrument is based on a versatile transmitter. The concept of the measurement was recently preliminarily tested for water vapor in a co-dedicated field campaign from 13 to 24 September 2021 over the Aubenais airfield (France, 44° 32' N 4° 22' E). This campaign was also an opportunity to test different approaches for the measurement of the vertical water vapor profile using classical meteorological probes embarked on meteorological balloons and on an airplane, a vibrational Raman lidar WALI (Weather Atmospheric Lidar), a cavity ring-down spectrometer (CRDS) and of course a first version of the LEMON lidar named WaViL (Water Vapor and Isotope Lidar). The field campaign involved an instrumented van with two lidars and three ULAs carrying various payloads: a backscatter Rayleigh-Mie lidar to identify atmospheric structures from the local to regional scales, a CRDS for water vapor isotope measurements and in situ samplers to characterize cloud-related forcing on atmospheric water vapor concentrations. The measurement strategy adopted made it possible to follow the evaporation of water vapor throughout the course of a thunderstorm and to sample an intrusion of dry air from high altitudes. It also provided initial answers as to the potential of the WaViL instrument for measuring the main isotope of water vapor and its secondary isotope HDO. The measurement campaign will be presented, as well as the first associated results.