CO2 levels rising in troposphere over rural areas

December 3 2009

This is an aerial view of the Research Center of the Lower Atmosphere where measurements are made. Credit: UVA.

Spanish researchers have measured CO2 levels for the past three years in the troposphere (lower atmosphere) over a sparsely inhabited rural area near Valladolid. The results, which are the first of their kind in the Iberian Peninsula, show that the levels rose "significantly" between 2002 and 2005.

Over recent years, physicists and meteorologists have been trying to find out about carbon dioxide (CO2) levels, and how these have evolved in the troposphere over various urban and rural areas around the planet. Now a scientific team from the University of Valladolid (UVA) has published the first - and to date the only - measurements for the Iberian

Peninsula.

The study, published in the latest issue of the journal *Theoretical and Applied Climatology* and led by Mª Luisa Sánchez, a researcher from the UVA's Atmospheric Pollution Group, shows that CO2 levels increased by 8 ppm (parts per million) between 2002 and 2005. A broader study has led the researchers to predict "an annual increase of 3 ppm" in the study area.

"The levels of this gas in uncontaminated atmospheres depend on emissions from the ground, as well as plant respiration and photosynthesis, but also on developments in the atmosphere as a whole, which may facilitate or inhibit the dispersal of this substance", Isidro Pérez, one of the authors and a researcher from the UVA's Applied Physics Department, tells SINC.

The scientists chose a flat, uncontaminated rural area located 840 metres above sea level and 30 kilometres from the city of Valladolid. Daily and seasonal cycles related to low level jet streams were also identified, using a turbulence indicator, the so-called Richardson number.

The increase in carbon dioxide was factored in with other characteristics observed in uncontaminated areas, such as differences between day and night. "This contrast, which is especially significant in spring, can be explained by plant respiration and photosynthesis processes, and by the turbulence or stratification of the atmosphere", explains Pérez.

Other characteristics of the troposphere

Data from a RASS sodar (a device that measures vertical temperature and wind profiles and that has a larger range than conventional meteorological towers) allowed the team to classify wind speed too. These data made it possible to obtain profiles that showed "the existence

of low-level jet streams at night time, which were especially low in summer, when they were located at a maximum height of between 200 and 300 metres", says the researcher.

The physicists also analysed the thermal structure of the lower atmosphere, and found "significant daytime cold advections (horizontal transportation of heat by an air current) in springtime, with temperature differences of 4.5ºC between the highest and lowest wind speeds", adds Pérez.

More information: Pérez, Isidro A.; Sánchez, María Luisa; García, María Ángeles; de Torre, Beatriz. "Daily and annual cycle of CO2 concentration near the surface depending on boundary layer structure at a rural site in Spain" Theoretical and Applied Climatology 98(3-4): 269-277, Oct 2009.

Source: FECYT - Spanish Foundation for Science and Technology