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The Relationship Between Ozone Uptake by Crops and Water Supply

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Vegetation generally acts as a sink for atmospheric ozone, in a process generally termed “ozone deposition”, resulting from a combination of vertical turbulent transport and penetration into the plant tissues. The latter step occurs through the stomata present on leaf surfaces. The deposition fluxes can be measured by micrometeorological techniques which, combined with resistance analysis, yield the stomatal contribution to the total ozone fluxes.

Stomata are used by plants to exchange gases such as water vapour, carbon dioxide and oxygen with the atmosphere. Their aperture is variable, and this property is used as a regulation process to maintain the leaf temperature at values that are sustainable for the plant, and to release more or less water vapour according to its physiological needs. But the flux of ozone penetrating the leaf depends on stomatal aperture and, in turn, on water supply.

In this work, compared results are presented, showing stomatal ozone fluxes over irrigated and non irrigated crops, such as onion and wheat. The irrigation of onions fields is periodical (about every 7 days) and is thus a good way of estimating water supply. It appears from the ozone deposition data that ozone fluxes are significantly higher just after irrigation (high water supply) that several days later (low water supply). This feature is not present for wheat, which was not irrigated. The relationship between water supply and ozone fluxes, which was hypothesized earlier, is demonstrated on examining the data presented here.

The dependence of ozone fluxes on water supply has regulatory implications at the scale of the European continent, since water supply is much lower in Southern than in

Northern Europe, whereas ozone concentrations is higher in the South. This shows that a flux-based approach is preferable respect to a concentration-based one on assessing ozone risk for vegetation.