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Ozone deposition to natural vegetation in the Easterm Mediterranean

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During the industrial age, anthropogenic emissions of fossil fuel have acted to approximately double the global mean tropospheric ozone (O_3) concentration. O_3 is an air-pollutant and a greenhouse gas, with dry deposition accounting for about 20% of its removal from the troposphere[1]. Better understanding of the mechanisms which control its dry deposition is currently required to improve its representation in regional and global models[2]. Studying the deposition of O_3 over vegetation, and its stomatal uptake is of special interest for several reasons: a) O_3 deposition over vegetation tends to be higher compared with non-vegetative land-use, but is highly complicated by chemical, physical and biological processes. b) stomatal closure by O_3 uptake tends to mitigate the carbon sink strength of vegetation, thereby also leading to an increase in atmospheric CO_2 and an increase in global warming[3]. c) O_3 adversely affects natural and agricultural plants functioning and growth, with damaging effect being strongly related to its integrated uptake by plant stomata. Ozone deposition is highly sensitive to meteorological conditions, via, for instance, O_3 concentrations, atmospheric stability, release rate of biogenic volatile organic compounds (BVOCs) from vegetation which react with O_3 as well as moisture amount and temperature of the surface to which the deposition occurs. Considering the warm conditions and strong photochemical activity typical to the Mediterranean regions O_3 deposition over vegetation under Mediterranean climatic conditions is of special interest. In the present study we applied the eddy covariance technique to study O_3 deposition over a mixed Eastern Mediterranean shrubbery in Ramat Hanadiv (Israel; 32˚33'19.87"N, 34˚56'50.23"E) during two consecutive years. Measurements of air-pollutants, including nitrogen oxides (NO_X = [NO] + [NO_2]), sulfur dioxide and carbon monoxide were used to study the impact of nearby air-pollution emission sources on O_3 deposition flux. The results indicate high O_3 removal rate over the vegetation and strong limitation on stomatal O_3 uptake. Nighttime O_3 deposition fluxes were remarkably high. Correlation of O_3 with temperature and relative humidity (RH) points out to stimulation of O_3 deposition flux with BVOC emission and surface wetness, respectively. Differently from previous studies correlation of O_3 deposition flux with RH was observed for RH significantly lower than 70%. Our results further demonstrate that characterization of vertical profile of NO_X concentration, rather than single point measurement, is required for adequate evaluation of O_3 flux under the studied conditions.

References

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