New field data for dry deposition velocity of aerosol particle as function of size from bare soil to forest: data acquisition, data processing and modeling inter-comparison

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Industrial facilities release in the environment radioactive or chemical species in aerosol particle form. These aerosols disperse in the atmosphere by turbulent motions then deposit on the ground by dry and wet mechanisms. In particular, dry deposition is characterized by a dry deposition velocity which is the ratio between the deposited flux and the atmospheric concentration. Nowadays, it is acknowledged that large uncertainties exist (e.g. about 2 orders of magnitude) on dry deposition velocities especially in the submicron range. In addition, there is no data for sizes corresponding to a few nanometers. A better quantification of the dry deposition velocity is required in order to better assess the impact of such facilities and, more generally, to better constrain climate models. The purpose of the present study is to obtain environmental data on dry deposition velocity and to compare data with existing models.

The Eddy Correlation technique was used to determine particle fluxes and dry deposition velocities over homogeneous flat surfaces. This technique has been used on four surfaces, such as bare soil, grass, maize (Damay, 2010) and forest during an experimental campaign carried out in July 2014. When the deposition velocity is dimensionless with the friction velocity, results between the different land covers (bare soil, grass and maize) are very close except for the forest, especially in the submicron range (Fig 1.) which corresponds to the Brownian motions.

The comparison of the results obtained on the forest with Slinn (1982) and Zhang et al. (2001) models show that none of the models correctly reproduces the measurements (Fig 2.). Nevertheless, Zhang et al. model best fits the measurements in the range of the Brownian diffusion and diverged in the range of impaction.

The objective of this paper is to present the methodology, experimental results and discuss the differences between models and measurements. In addition, the work planned between 2015 and 2017 will be presented.

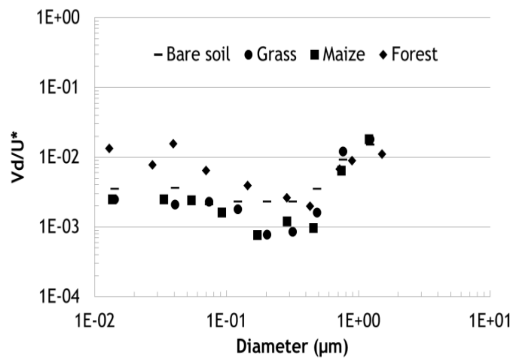

Figure 1: Dry deposition velocity dimensionless with the friction velocity for bare soil, grass, maize and forest.

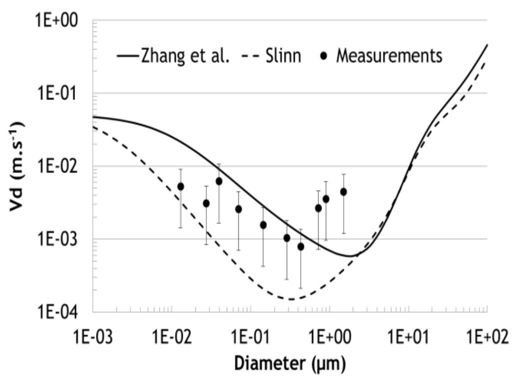

Figure 2: Comparison between measurements and two models on the forest.

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