[EJ] Evening Poster | A (Atmospheric and Hydrospheric Sciences) | A-AS Atmospheric Sciences, Meteorology & Atmospheric Environment

[A-AS06]Atmospheric Chemistry

convener:Yoko Iwamoto(Graduate School of Biosphere Science, Hiroshima University), Tomoki Nakayama(Graduate School of Fisheries and Environmental Sciences, Nagasaki University), Sakae Toyoda(東京工業大学物質理工学院, 共同), Nawo Eguchi(Kyushu University)
Wed. May 23, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)
This session provides a forum for the presentation of the broad spectrum of tropospheric and stratospheric chemistry, including various research topics (e.g., dynamical processes, air quality and climate), approaches (modeling, field measurements, remote sensing, and laboratory studies), and species (gas and aerosol). This session also provides an opportunity for discussing possible future collaboration with other research fields relevant to atmospheric chemistry.

[AAS06-P11]A Semi-Analytical Model to simulate short-range dispersion of pollutants in the atmospheric boundary layer

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Analytical models are indispensable tools to study the ad-hoc problems connected with the severe impacts of harmful air pollutants. The analytical models based on the solution of the advection-diffusion equation have been the first and remain the convenient way for modeling air pollutant dispersion as it is easy to handle the dispersion parameters and related physics in it. A semi- mathematical model describing the crosswind integrated concentration is presented. The analytical solution to the resulting advection-diffusion equation is limited to constant and simple profiles of eddy diffusivity and wind speed. In practice, the wind speed depends on the vertical height above the ground and eddy diffusivity profiles on the downwind distance from the source as well as the vertical height in the short-range dispersion. In the present model, a method of eigenfunction expansion is used to solve the resulting partial differential equation with the appropriate boundary conditions. This leads to a system of first-order ordinary differential equations with a coefficient matrix depending on the downwind distance. An approach based on Taylor’s series expansion is introduced to find the numerical solution of the resulting first order system. The method is applied to various profiles of wind speed and eddy diffusivities. The solution computed from the proposed methodology is found to be efficient and accurate in comparison to those available in the literature. The solution derived is used to deduce the concentration distribution at all the points in the domain by assuming a Gaussian distribution in the crosswind direction. The performance of the model is evaluated with the diffusion datasets from Prairie Grass experiment in various stability classes varying from very unstable to neutral and stable conditions. In addition, it is evaluated using low wind diffusion data taken from Idaho experiments in stable conditions.