IMPLEMENTATION AND VERIFICATION OF VERTICAL DIFFUSION SCHEME IN THE EMEP MODEL

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Abstract: Vertical diffusion is a very important parameter introduced by turbulence closure theory that represents the strength and intensity of vertical mixing in the atmosphere. The vertical eddy diffusion coefficient (K(z)) is the main quantity in models for vertical distribution of different atmospheric components and pollutants. Implementation and verification of different schemes for parametrization of vertical diffusion has been a goal of the international project Environmental Modelling and Evaluation Programme for Croatia (EMEP4HR). The European Monitoring and Evaluation Programme (EMEP) presently uses a simple K-theory parameterisation for vertical diffusion based on non-local O'Brien (1970) formula in atmospheric boundary layer (ABL) and with Blackadar, local approach, above the ABL. A new approach of vertical exchange in the EMEP model uses generalized form of the O'Brien's third-order polynomial K(z). It is a linear-exponential function with convenient analytic properties (Grisogono and Oerlemans, 2002) through the ABL while a semi-local approach is used above the ABL. The new scheme and the operational scheme, O'Brien, have been validated for 2001. For verification, surface measurements of different chemical elements in EMEP domain are used. Simulations of radon-222 (222Rn) data with the EMEP model using these two sets of vertical diffusion coefficients are compared to one year of hourly surface measurements of 222Rn at the station Pallas in Finland in 2001. Correlation coefficients, root mean square error (RMSE) and BIAS values between the measurements and the modelled daily concentrations for both K(z) methods are presented and the new scheme is recommended for practical application.