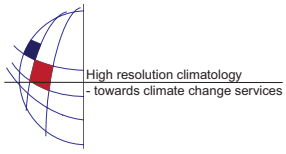
EMS Annual Meeting Abstracts
Vol. 7, EMS2010-291, 2010
10th EMS / 8th ECAC



The influence of source periodicity on formation of large scale spottiness of the total deposition

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In this work we have studied the formation of a large-scale spot-like structure of the cumulative deposition pattern at the regional scale (linear size of 10^5-10^6 m or larger) due to a powerful elevated source. Only one possible cause of spottiness at the regional scale, namely the diurnal cycle of the vertical turbulent mixing intensity in the atmospheric boundary layer (ABL), has been taken into account in this study. Based on numerical and analytical solutions of model diffusion problems (using the K-theory approximation) we have studied how the nonstationarity/periodicity of a source acting for a limited time interval, t_k, affects the formation of spottiness. The source periodicity was specified in the form of a simple harmonic function (cosine) for source strength, Q=f(t). The main focus of our study was on the case when the source lifetime is longer than the characteristic time of the periodic change of the ABL structure, i.e. $t_k > T$ (in this case the spottiness does not appear when the source is stationary, Q=const). The results of our modeling demonstrate that under the condition Q=f(t) there may exist a resonant mode, which can cause spottiness when $t_k > T$. The resonant mode (strengthening of the periodic action of the spottiness formation mechanism) exists when the periods of the source strength and the vertical turbulent mixing intensity are approximately equal, while the phases of their oscillations are opposite.