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The basic properties of non-local parametrization of a turbulent exchange

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At mathematical modeling of the dispersion of gas-aerosol impurity is used basically local parameterization of a turbulent exchange. In this case is supposed, that of a turbulent diffusion flow is proportional to a gradient of defunding substances concentration (n). This assumption is applicable only then when the characteristic size (l) of inhomogeneities of n essentially exceeds the characteristic size L of turbulent "moles". However, at solution of various applied problems rather frequently meet situations, when $l \leq L$. It is natural, that in this case parameterization of a turbulent exchange should have non-local character.

In this research one of possible scheme of non-local parameterizations of a turbulent exchange for situations, when $l \sim L$, is supposed and proved. This scheme is based on idea of representation of a turbulent flow **j** as Fredholm's convolution of function n and the function K, describing intensity of turbulent fluctuation of environment, namely

$$\mathbf{j} = -\operatorname{grad} \int K(\mathbf{r} - \xi)\cdot n(\xi)\, dV,$$

where V is a volume of dispersion of a gas-aerosol impurity, $\mathbf{r}\in V$, $\xi \in V$, integrating carried out on a variable ξ, grad is the linear differential vector-operator (gradient) influencing on a variable **r** (other representation grad=$\partial/\partial\mathbf{r}$), the function K is a non-local analogue of coefficient of diffusion (this function at $L/l \to 0$ turn to Dirac's delta-function).

The problems for which it is possible to receive the analytical solution of the equation of diffusion with the supposed non-local parameterizations of a turbulent exchange are formulated. The solutions of these problems are based on an opportunity of application of Fourier's transformation of the equation of diffusion.

The analysis of these solutions is carried out with the purpose of an establishment what new features during a turbulent exchange appear at their mathematical modeling with the help of non-local parameterizations. It is proved, that for a situation $l \leq L$ the adequate mathematical modeling of a turbulent exchange possible only in view its non-local character.