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Fractal features of the large-scaled low frequency atmospheric processes and formations

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Refrences:

The fractal structures (with fractal dimension *D*∼*4/3)* may be realized in different systems (c.f. Mandelbrot, 1983) , including the atmospheric turbulence, ocean and hydrological systems. In our paper there are studied the fractal features for large-scaled low-frequency atmospheric processes and atmospheric formations energy evolution. Earlier the new method of monitoring the low-frequency planetary scale processes on the basis of observing some summated contributions of low frequency oscillations for geophysical factors were developed. They base on the energy and angle moment balance relations and new scheme for calculation of the macro-turbulence regime in typical atmospheric processes, which are known as atmospheric circulation forms (Glushkov et al, 2001, 2003, 2005). The balance analysis allows to predict the large-scaled atmospheric transformations and teleconnection phenomena and to give their quantitative description. We carried out a group of numerical experiments on calculation of the energy and angle moment and moisture turnover in the Pacific ocean region .The current function (complex velocity) fields are calculated for typical atmospheric circulation's forms. The experiments allow quantitatively defining a link between atmospheric turnover and atmospheric circulation forms through the front divider position and typical low frequency process of conservation of the angle moment balance. If the field of large scaled velocity is known (the vortexes of scale lare excited) then a cascade scale dividing process leads to hierarchy of vortexes of the scales l_n∼*q*-$^{n}l_o(q - --$ the scale division parameter). Process of the energy transfer on scaled cascade is chaotic one. As result, anisotropy and large scaled in-homogeneity of the velocity field influences on statistical pulsation regime in less degree during decreasing the scale that is led to scaled invariance and local anisotropy on sufficiently little scales. For isotropic pulsation the energy distribution on scales *(l*∼*k*-$^1, k - --$wave number) is defined by spectral density $E(k)$. Simple physical arguments allow to introduce a characteristic pulsation period $T \sim [E(k)k]^{-1/2}$, $k_m \sim l_m^{-1}$ Under sufficiently big values of M it is true a scaled invariance and scaling representation: $E(k) \sim k^{-a}$. After M dividing fractions insist of the single initial vortex it will be N $\sim q$ number of vortexes of the scale lì$\sim$ ql_0. This system of vortexes will occupy some volume in a space with effective size l_0, and it can be written: $N \sim l_*^{Ds}$, where D_s is a fractal dimension. Numeric calculations of the fractal dimension allowed obtaining the following values: 1,3-1,7 (fig.1).

Fig.1. Fractal features in the energy spectra of large-scaled atmospheric formations

References

Mandelbrot B., (1983) The Fractal Geometry of Nature , N.-Y., 469 p.; Glushkov A., Khokhlov V., (2001) Teleconnection, Hadley cells, energy and momentum balance, in: Zuev V D (ed.), Ecology of Siberia, the Far East and the Arctic, p.133-138;

Glushkov A.V., Loboda N.S., Khokhlov V.N., 2005 Atmosph. Res. (Elseiver) , to be published;

Glushkov A.V., Khokhlov V.N., Loboda N.S., Ponomarenko E.L., (2003) Environm. Inf. Arch.. 1, 125-130