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Letter to the Editor

On the applications of thermodynamic climate models of J. Adem in Russia

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Dear sir:

My colleagues and I read with great interest issues of your new scientific journal "Atmosfera". We also highly appreciate scientific works and results, obtained at the Center of Atmospheric Sciences of the National University of Mexico. Your approach to the investigation of the climatic system and your models are applied by many Russian researchers. Unfortunately, appropriate Russian works are often poorly known abroad, because they are in Russian. That is why, perhaps, it would be interesting for you and the readers of "Atmosfera" to see an English translation of the bibliography of Russian works, related to your models (with some comments).

There are two independent groups dealing with your models in two major Russian cities, Leningrad (now St. Petersburg) and Moscow. Their approaches to your models were somewhat different. In St. Petersburg, mainly in the Polytechnical Institute (Russian analog of MIT) under the guidance of Dr. Rusin, researchers made an attempt to modify your model in order to fit the system of its input parameters to the data available in the former USSR, and aiming at obtaining as output climatological fields and seasonal dynamics close to appropriate Russian observational data sets.

In Moscow, at the Department of Oceanology of the Moscow State University, and later at the Water Problems Institute of the Russian (formerly Soviet) Academy of Sciences, we tried to investigate the dynamics of monthly anomalies and the stochasticity of climatic systems using your models. Experiments on the simulation of climatological fields were also carried out earlier (see papers by E. S. Yarosh), and some modification of the model itself were made.

The very beginning of this "Moscow" activity was in the middle of the seventies at the Moscow State University. Later I carried out similar experiments at the Water Problems Institute, continuing, at the same time, my lecturing at the MSU. The Oceanic Part of your model, its place in the hierarchy of climatic models and my results were described in an appropriate manual for oceanographers (see Dobrovolski, 1983). Gifted students (A. Ostrovski, E. Yarosh, O Rybak and some others) were interested in your models. They prepared Master Degree papers related to your approach, and became post-graduates at the Water Problems Institute applying your model in their Candidate Theses. After obtaining the Candidate Degree (corresponding to the US Ph. D), they went to other institutions to work: A. Ostrovski, to the Shirshov Oceanological Institute of the Russian Academy of Sciences, and O. Rybak, to the Sochi Scientific Center of the Academy of Sciences. Some of them went to new "foreign" countries (e.g. E. Yarosh went to work in Minsk, Byelorus). Thus, your approaches are widely spread via Moscow.

Perhaps, the list of works shown below is not complete. Evidently, I am not sure that I know all your Russian colleagues. Only works, where your models are widely used, are mentioned. Surely, there are many other papers and review books, and manuals, where your papers are cited and briefly described. I think, that the most complete description of the "Moscow" applications of your models is given in the Candidate Thesis by O. Rybak (1992).

Your models are one of the most important approaches, completely original, fruitful, and powerful, in the Earth Sciences. It is a whole ideology of the most advanced system of models, essentially based on properly chosen climatological time scales. One can easily predict other applications and "advertisements" of your models: manuals, text-books, sets of computer programs for beginners and experts, etc.

Very sincerely yours

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CHRONOLOGICAL LIST OF WORKS

1. Dobrovolski, S. G. (1976). Interannual Variability of Hydrometeorological Characteristics in the Zone of Subarctic Water Cycle of the North Pacific Ocean. Candidate Thesis. Moscow State University, Moscow, 133 pp. (in Russian)

   (Deterministic experiments with the Joint Ocean-Atmosphere Adem model, applied for the description of large-scale sea surface and tropospheric temperature anomalies in the Northern Hemisphere and the North Pacific).

2. Dobrovolski, S. G. and R. K. Klige (1980). Long-term variability of the sea surface temperature. Proc. of the VII Congr. of the USSR Geographical Union, Frunze, P. 73-83 (in Russian).

   (First results of experiments with a dynamic-stochastic model of the sea surface temperature anomalies, developed on the basis of the Adem oceanic model.)

3. Rusin, I. N. and A. S. Averkiev (1980). On the exactness of the simulation of near-surface air temperature norms using the Adem model. Leningrad Polytechnical Inst., Leningrad, Deponent No. 249-80, 23 p. (in Russian).

   (An attempt to modify the Adem model in order to simulate global climatological fields of the near-surface air temperature, averaged over seasons.)

4. Rusin, I. N. and A. V. Morachevski (1980). On a possibility to simulate azonal temperature deviations, using a simple model. Leningrad Polytechnical Inst., Leningrad, Deponent No. 2431-80, 17 p. (in Russian).

   (Further modifications of the Adem model in order to obtain improvements, from the author's point of view, in the zonal distributions and global patterns of mean seasonally averaged air temperatures.)

5. Rusin, I. N. (1981). Simple model of the thermal regime of the atmosphere – ocean – continent and simulation of the seasonally averaged near-surface temperature norms. Leningrad Polytechnical Inst., Leningrad, Deponent No. 3889-81, 30 p. (in Russian).

(Improvements, from the author's view point, of the Adem oceanic model in order to simulate realistic distribution of climatological sea surface temperatures on a global scale.)

6. Rusin, I. N., and A. S. Averkiev (1981). Simulation of seasonal dynamics of the "atmosphere – ocean – continent" thermal system, using a simple model. Leningrad Polytechnical Inst., Leningrad. Deponent No. 3894-81, 18 p. (in Russian).

(A seasonal variant of the Rusin modification of the Adem model, with the comparison of observed and computed seasonal changes in the global patterns.)

7. Dobrovolski, S. G., R. K. Klige, A. S. Ostrovski and E. S. Yarosh (1982). Long-term variations of the sea surface temperature in the North Atlantic. Proc. of the II Congr. of Soviet Oceanographers. Sebastopol, Institute of Marine Hydrophysics of the Ukranian Academy of Sciences, p. 167-169 (in Russian).

(Comparison of the simulated and the observed data, using a dynamic-stochastic global variant of the Adem oceanic model. Maximum Enthropy Method in the Burg variant is used in this study.)

8. Dobrovolski, S. G. (1982). Simple dynamic-stochastic model of large sea surface temperature anomalies in the ocean. Meteorologija i Gidrologija, No. 6, p. 68-75 (in Russian). English translation: Soviet Meteorology and Hydrology, Allerton Press Inc., N. Y., 1982 No. 6.

(Description of the global two-dimensional dynamic-stochastic variant of the Adem oceanic model.)

9. Dobrovolski, S. G. (1983). Numerical modelling of large-scale ocean-atmosphere interaction. In: "Interactions Between the Ocean and Environment". Ed. A. I. Duvanin, the Moscow University Press, Moscow, p. 168-189 (in Russian).

(A description of Adem model and its place in the hierarchy of models, using the K. Hassel mann classification. Description of my own results and the discussion.)

10. Yarosh, E. S. (1986). On the application of the Adem model for estimating mean monthly values of the tropospheric water content. In: Peculiarities and regularities of land water formation. Part 1. Water circulation processes. Water Problems Institute, Moscow, p. 96-102 (in Russian).

(Calculations of the atmospheric water vapour content using Adem formulae for different seasons over the whole territory of the former USSR and the comparison with the observed fields.)

11. Yarosh, E. S. (1986). Seasonal anomalies in the atmospheric branch of the hydrological cycle characteristics (area of the USSR), Candidate Thesis. Water Problems Institute, Moscow, 100 p. (in Russian).

(Statistical analysis of monthly anomalies of air humidity, water vapour content, its transport at the 850 mb surface and averaged for a whole tropospheric layer for 42 aerological stations on the territory of the former USSR. Calculations of statistical parameters of monthly anomalies of the above characteristics using the stochastic variant of the Adem model (atmospheric variant) and the comparison with the results of the statistical analysis of observational data.)

12. Ostrovski, A. G. and L. I. Peterbarg (1986). On fitting a numerical model of the sea surface temperature anomalies to the observed data. In: Modelling Hydrophysical Fields and Processes in the Ocean. Nauka Publishers, Moscow, P. 133-140 (in Russian).

(Parameters of a model, developed on the basis of the Adem oceanic model, are estimated using the observational data for the North Atlantic. Discussion on the role of different processes in forming SST anomalies.)

13. Dobrovolski, S. G. (1986). Modelling large-scale anomalies of global heat and water circulation. Proc. of the All-Union Conf. "Hydrology – 2000". Soviet Geophysical Committee, Moscow, p. 208-210 (in Russian).

(The first attempt to formulate the problem of dynamic-stochastic description of the global heat and water cycle, using the Hasselmann theory and the Adem model.)

14. Dobrovolski, S. G. (1991). Anomalies of the global heat and water exchange. Stochastic models. The Soviet Geophysical Committee, Moscow, 128 p. (in Russian, with the abstract in English).

(In addition to previous results, dynamic-stochastic models of the global anomalies in evaporation from the sea surface and models of global air temperature patterns are presented. Furthermore, a more detailed description of the method of stochastic forcing of the Adem model is given, and other theoretical and methodological problems are discussed.)

15. Dobrovolski, S. G., O. O. Rybak and E. S. Yarosh (1991). Contruction of dynamic-stochastic heat and water exchange climate models, using the approach of J. Adem. Geofísica Internacional, Vol. 30, No. 1, p. 5-12.

(The first review arcticle in English, briefly describing our previous results. There are also some ideas for future works in this field.)

16. Dobrovolski, S. G. (1992). Global climatic changes in water and heat transfer-accumulation processes. Elsevier Science Publishers, Amsterdam, London, New York, Tokyo, 280 pags. Vol. 21 of the series "Developments in Atmospheric Sciences".

(Description of different problems, related to climate changes in different time and spatial scales – from one month to dozens of thousand years and from local to global scale. The Adem model and its dynamic-stochastic modifications are very important in formulating hypotheses, description of results and discussing ideas in this book).

17. Dobrovolski, S. G. and O. O. Rybak (1992). Incorporation of hydrological cycle elements into the dynamic-stochastic climate model. GeoJournal, Vol. 27, No. 3, July 1992, p. 247-254.

(Results of experiments with a dynamic-stochastic variant of the Adem model, where the water conservation equation is included into the model equations, and humidity and temperature fields in the atmosphere are mutually fitted by an iterative numerical procedure.)

18. Rybak, O. O. (1992). On the application of a dynamic-stochastic climatic model to the simulation of the oceanic upper layer thermal variability. *Atmósfera*, Vol. 5, No. 4, p 181-192.

(Investigation of monthly anomalies of the sea surface characteristics and parameters of ocean – atmosphere interactions, using the advanced dynamic–stochastic model, developed on the basis of the Adem model.)

19. Dobrovolski, S. G. (1992). Anomalies of the global heat and water exchange. Russian Doctorate Thesis. The Moscow State University, Moscow, 402 p. (in Russian).

(The most complete description of my vision of the climate variations problem, including my own variant of the approach to the development of atmospheric dynamic-stochastic models, using the Adem model. Description and revision of all our previous results, appropriate discussion and formulation of new hypotheses.)

20. Rybak, O. O. (1992). Dynamic-stochastic model of anomalies of heat and moisture exchange in large regions. Candidate Thesis, the Moscow State University, Moscow, 180 p. (in Russian).

(The most complete description of the visions of O. O. Rybak on the problem of developing dynamic-stochastic models for large regions on the basis of the Adem systems of models.)