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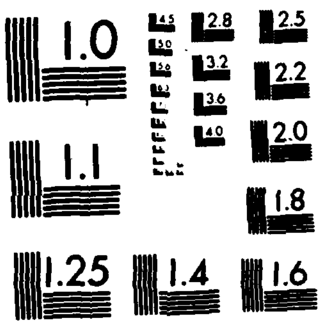
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OPERATIONAL SOIL MOISTURE PREDICTED MODEL

BY

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5th Progress Report

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During the report period correction and improvement of the model III has been continued (see the Periodical Reports 1, 2, 3, 4). The seeking and collecting of the observational data and also the writing of the first paper was begun. Specifically the following work was carried out:

1. The different terms of the subsurface hydrology equations for unsaturated vapor - liquid flow were evaluated. These estimations proved that for the case of the problem under investigation some terms can be dropped without detriment for the precision of the solution.
2. Different empirical relationships between physical parameters of the soil on the one hand and its moisture on the other have been sought in the current literature and tested from the point of view of their relevance for our problem. As a result the most pertinent relationships were chosen.
3. The current literature was examined for the optimal existing methods for simulating water uptake by plant roots. A method was found that was exact enough, yet not overly complicated, in order to be of comparable precision with the remainder of the model.
4. Semiempirical relationships describing the laws of a thin atmospheric layer moving over vegetation cover which are analogous to the laws of so called surface layer over bare soil have been sought in the current literature. As a result, the relationships which were successful for the general circulation problem and which were also relevant for our problem were choosen.

5. An improved numerical method for the calculation of the effective surface foliage temperature and of the liquid water detained by the foliage surface was worked out. Our method of solution is new. The problem was reduced to an interactive solution of certain transcendental algebraic equations, the form of which depends on what takes place on the foliage: evaporation or condensation.
6. The finite-difference scheme of the soil surface boundary conditions has been improved. This methodology takes into account precipitation and runoff. It allows for the condition of filtration into the soil or its drying, depending on the direction (up or down) of the moisture flux through the surface.
7. Interactive part of the solution of the finite-difference soil moisture and temperature equations have been improved also. Namely, a successive approximation method, linking the analytical and the numerical parts of the solution was developed.
8. A set of analytical expressions simulating the march of the meteorological elements at a shelter level height has been selected. They allow for different meteorological situations (for example, heavy showers, cold invasion, etc.). These analytical expressions are necessary for checking and debugging the model until we have real meteorological data.
9. A simplification of the numerical scheme and the subroutines for the aim of operation applications of the model has been carried out.

10. The search of the literature and other sources and also the selection of the observational data for the atmosphere (wind, temperature, humidity, precipitation) and for the soil (temperature and moisture) pertinent for a testing of the model has been carried out. This work encounters some difficulties, in as much as such data available are insufficient for our purposes. In order to draw conclusions about the accuracy of our model, it is necessary to have what can be called complex data, i.e., soil moisture and temperature data for the same depths and for the same moments of time and also corresponding simultaneous meteorological data. Besides, we need some information about physical parameters of the soil and of the vegetational cover. During the fall of 1982 the author visited some institutions and universities of the U.S.A. looking for available complex experimental and observational data. At the U.S. Army Cold Regions Research and Engineering Laboratory (Hanover, N.H.) the author was told that they have complex data as defined above which can be made available if there is special permission from U.S. Army Contracting Agency.

In conclusion we present a brief statement of research plans for remainder of contract period.

1. The continuation and the completion of the programming and the final debugging of the program.
2. The evaluation of the accuracy of the finite-difference approximation by calculations with the artifically simulated data.

3. The continuation and the completion of the observational data selection.
4. Comprehensive (detailed) tests of the model by comparing results of computations with observational data.
5. The writing of the Final Technical Report.

5.25.1983
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