WEATHERING THE STORM: LESSONS FROM THE DATA OF A WATERSHED ECOSYSTEM

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Introduction

A simple model attempts only a rudimentary explanation of the real world. The hydrology model in this paper attempts to be the most elementary possible model of the week-to-week flow of a northern New England hardwood forest stream. The goal of the present model is to approximate the "ideal" forest and to refine the definition of "ideal". In constructing such a model, every effort should be made to run it under "ideal", "quiet" conditions.

Unfortunately, real air temperature, precipitation, and streamflow vary considerably from the ideal. The purpose of this paper is to discuss each of these three sets of data in turn, extract some estimates of ideal behavior, and see how these estimates work in a very simple model.

The three sets of data to be examined vary. Two, temperature and precipitation, feed the model; the third, streamflow is the result of the model.

The model is dynamic. It attempts to explain the behavior of the system a week at a time over the course of a year.

As one examines the data, one must explain first the behavior across the year. After examining the data, one must decide what, if any, simplications are needed to understand ideal behavior and its relation to the most elementary possible model. Again, the aim of the elementary model is to consolidate the understanding of ideal behavior...

Conclusions

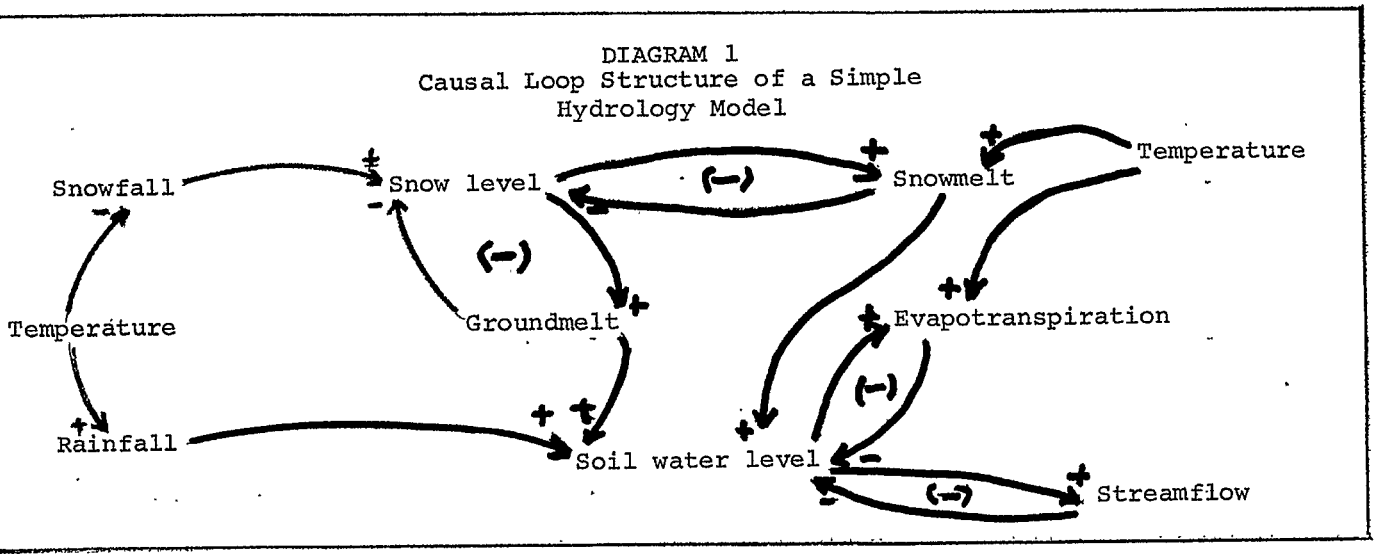
When working with natural systems, it is wise to distinguish between the quiet and the noisy state of the system. If one is trying to develop the most elementary model possible, efforts should be made to eliminate as much noise as possible. The median measure of central tendency can help to sort out this quiet behavior and, in fact, can define it.

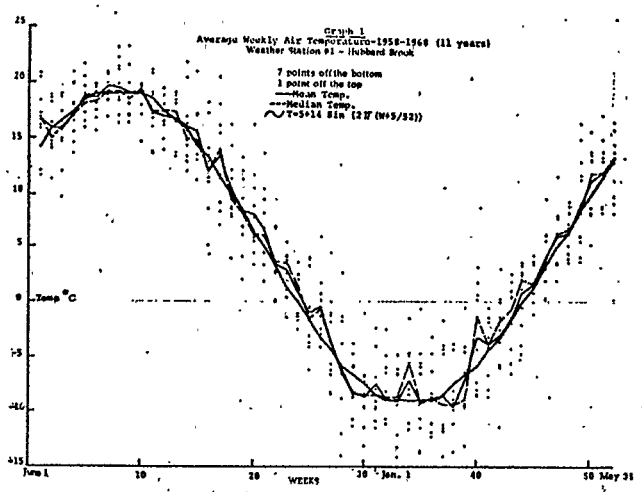
An elementary model can provide a reasonable explanation and further definition of "ideal" behavior.

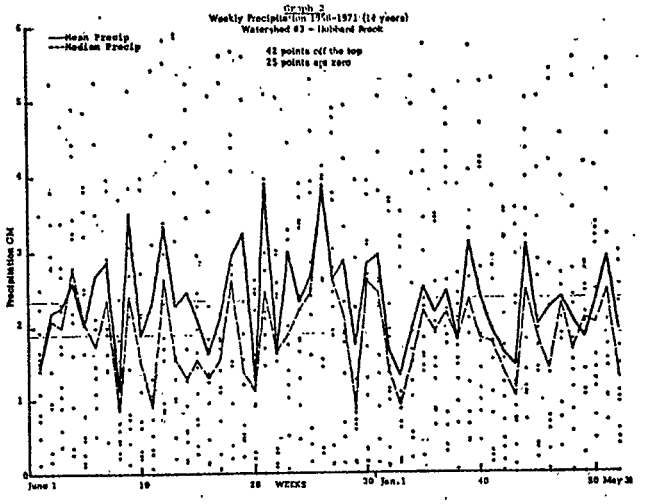
Note

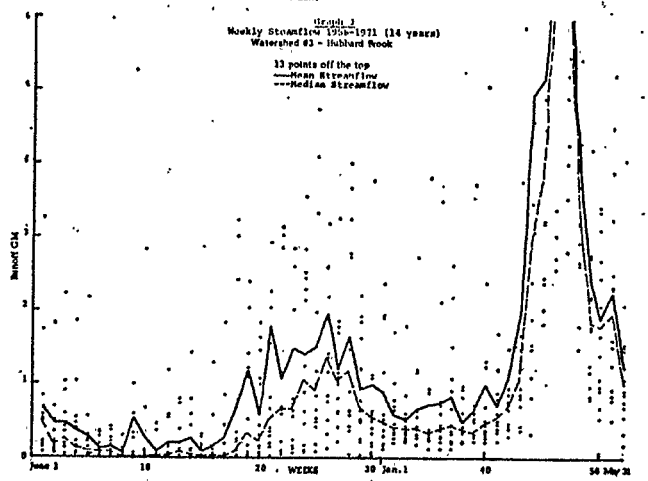
Following a simple diagram of the model are six illustrations which the original paper discusses in detail.

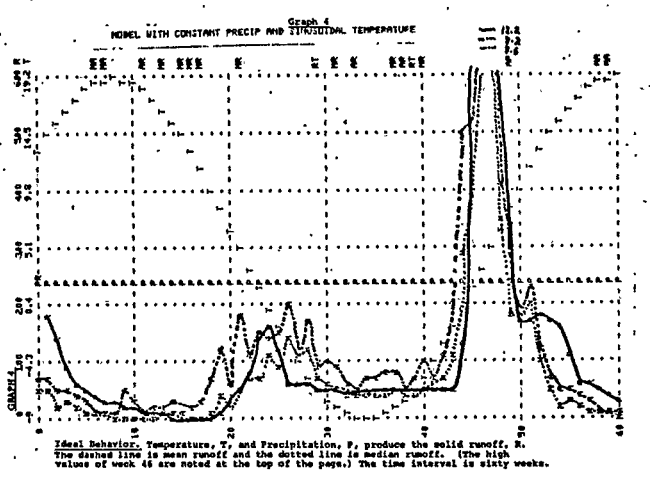
DIAGRAM 1
Causal Loop Structure of a Simple Hydrology Model



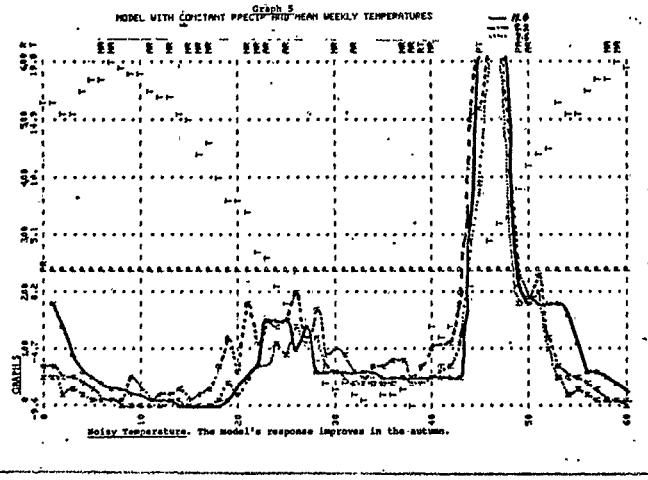




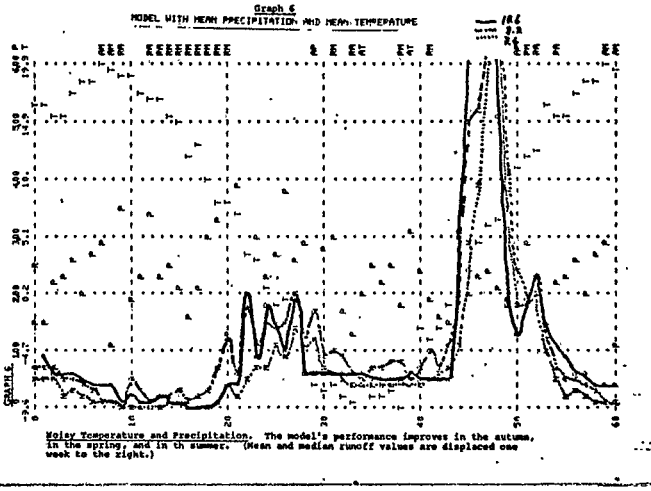




Ideal Behavior. Temperature, T, and Precipitation, P, produce the solid runoff, R. The dashed line is mean runoff and the dotted line is median runoff. (The high values of week 46 are noted at the top of the page.) The time interval is sixty weeks.



Noisy Temperature. The model's response improves in the autumn.



Noisy Temperature and Precipitation. The model's performance improves in the autumn, in the spring, and in th summer. (Mean and median runoff values are displaced one week to the right.)