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Comparative Hydrometeorology of Temperate and Semiarid Environments in India

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Introduction

Out of a total cropped area of 178 m ha, India has 59 m ha of irrigated cropland. The remaining 119 m ha is rainfed. Crop production under rainfed conditions either occurs during the rainy season or depends on conserved or residual soil moisture. In temperate countries, the economy largely depends on production of goods and services that are less affected by the variabilities of weather. Although India receives adequate amounts of rainfall annually through the four different types of weather phenomena—southwest monsoon (74%), northeast monsoon (3%), pre-monsoon (13%), and post-monsoon (10%)—the distribution in time and space is erratic, resulting in a limitation on the length of crop-growing periods (LGP) or the occurrence of floods.

The temperate environment of Kashmir consists mainly of two crop growing seasons extending from May to October (summer) and November to April (winter). Rice, maize, cowpea, and beans are some of the important summer crops, while rapeseed, berseem, oats, and wheat are grown as winter crops. Under the semiarid conditions of Rajasthan, some

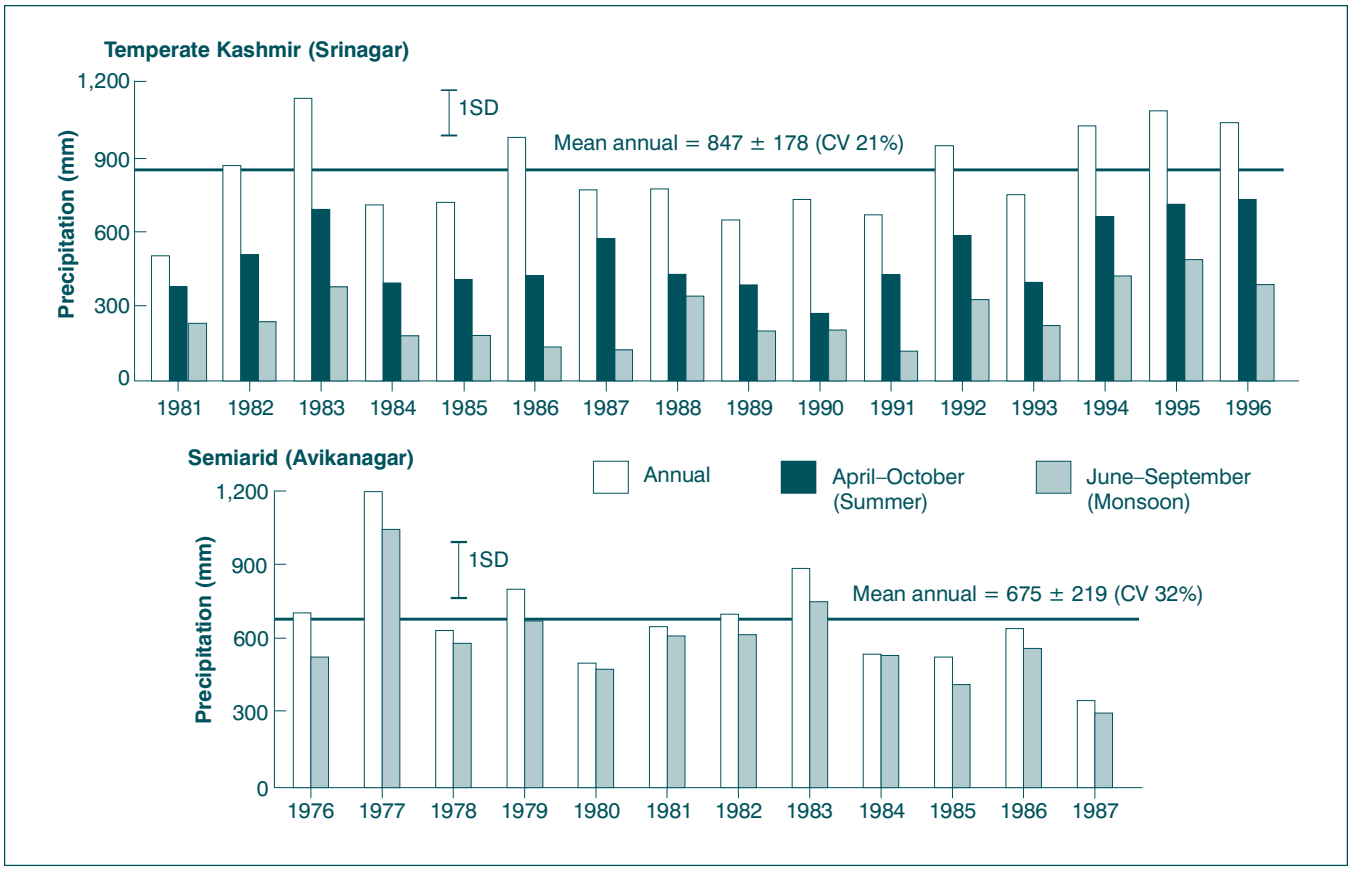

Figure 1. Comparative patterns of precipitation.

drought-resistant crops like pearl millet, cowpea, guar, and foxtail grass are cultivated during the summer monsoon season (June to September), while the ensuing winter season up to February experiences various degrees of moisture stress. Crops grown in this winter season are mostly irrigated. This season is followed by a third one, with hot and dry weather (February to June).

Rainfall Pattern

The characteristic patterns observed over the years are shown in Figure 1. The figure shows that variability occurs more in semiarid (CV=32%) than in temperate (CV=21%) environments. The Indian summer monsoon rainfall (June–September), which is known to contribute maximum rains through the southwest monsoon (74%), assumes less importance under temperate conditions. The same type of rainfall makes its maximum contribution under semiarid conditions. In temperate Kashmir, summer rainfall (April to October) is greater; this type of rainfall is more important for summer crop production in temperate environments.

Water Balance

The water balance figure for the two regions is shown in Figure 2. It shows that there is a small period of moisture stress under temperate conditions extending from June to September, whereas under semiarid conditions, moisture stress is prolonged and extends from November to June (8 months). Also, evaporation exceeds rainfall from April to mid-November under temperate conditions, but this phenomenon is quite extended in semiarid regions, indicating a severe limitation on the length of the crop-growing period. Most of the time the maximum temperature remains above 20° C under semiarid conditions, but temperature regimes of such magnitude are found only for 6 months (May to October) in temperate environments.

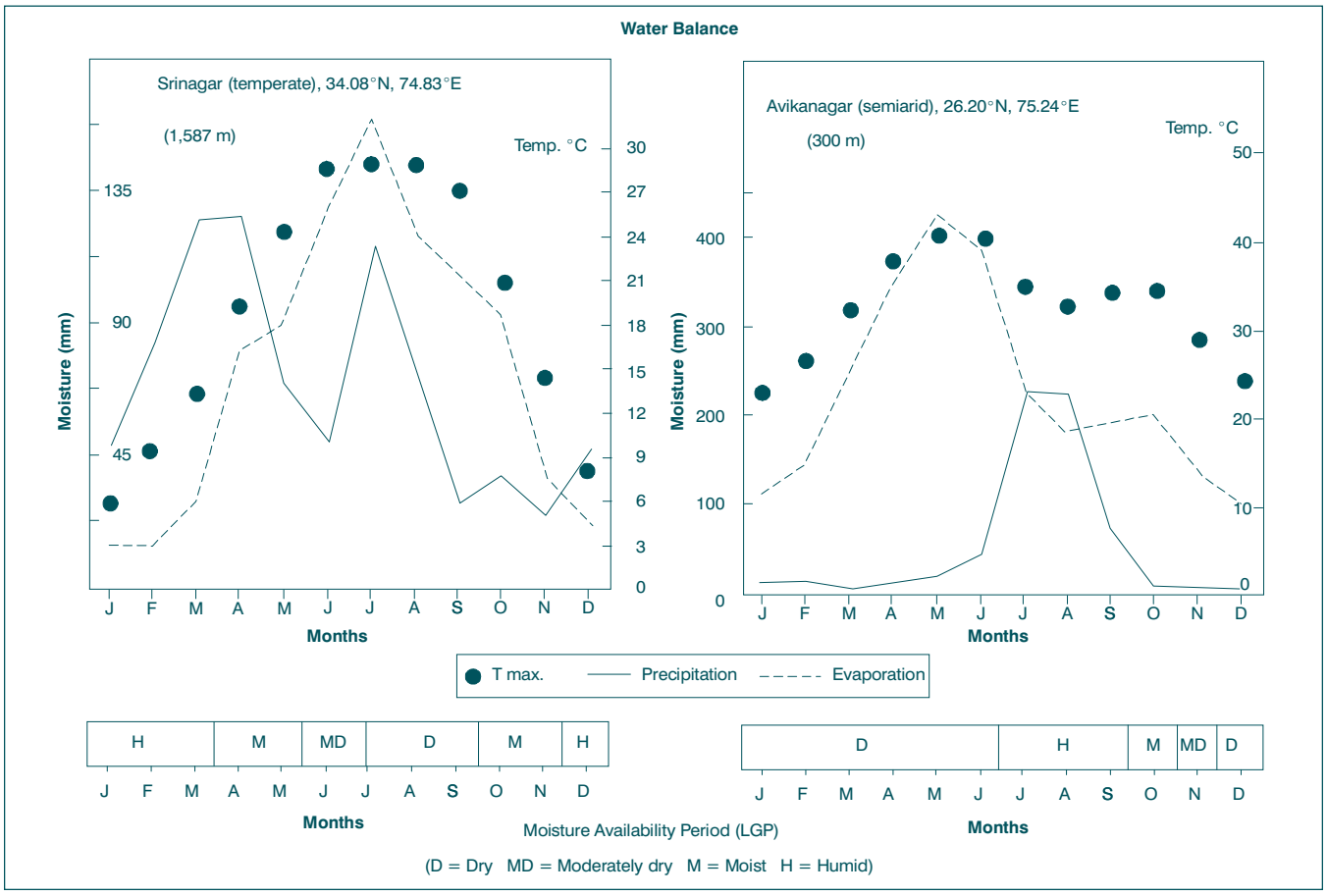

Figure 2. Water balance for Srinagar and Avikanagar.

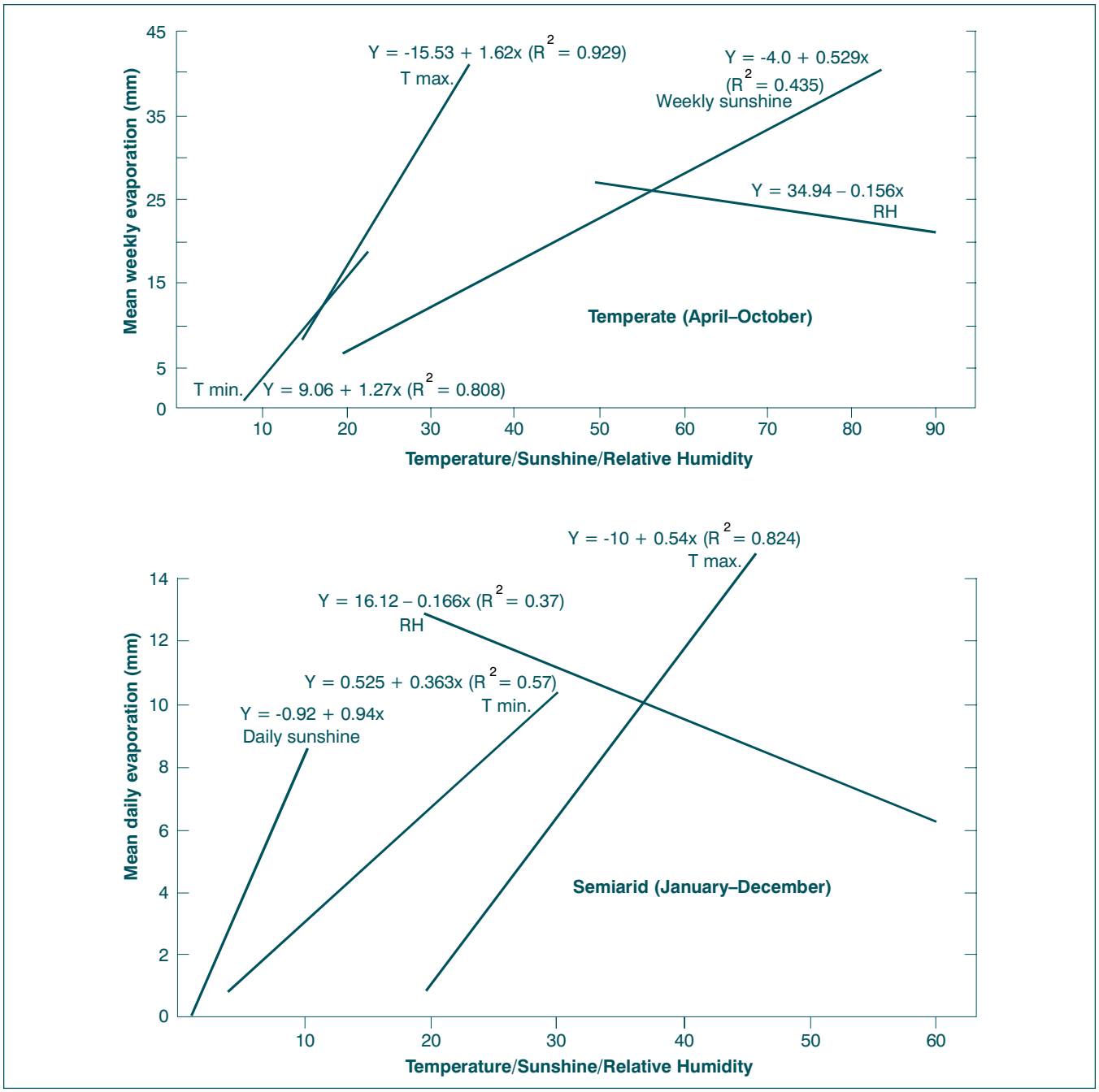

Figure 3. Regression equations of various weather variables in relation to evaporation.

Evaporation

The regression equations of various weather variables in relation to evaporation are shown in Figure 3. Here evaporation has been taken as the dependent variable (Y), and an analysis of the graphs shows its maximum dependence on maximum temperatures under both temperate and semiarid environments. It is also quite clear from the figure that all weather variables except relative humidity have been found to be positively correlated with evaporation.

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