

# NASA TECH BRIEF

*Ames Research Center*



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## Remote Estimation of Soil Moisture

Quantitative knowledge of soil moisture in large regions of the earth could provide useful inputs for agricultural purposes, for example, in studies involving the relationship of soil moisture to crop growth; estimating slope stability in land masses which are susceptible to landslides, especially those made of clay minerals, is but another example of the usefulness of soil moisture information. A review of recent literature and the results of exploratory investigations in the laboratory indicate the possibility of assessing soil moisture remotely, say, from aircraft.

The two methods under consideration for making remote estimates of soil moisture involve measurements made in the electromagnetic spectral region of 0.4 to 14.0  $\mu\text{m}$ : (1) spectral reflectance, (2) soil temperature. The reflectance method is based on observations which show that directional reflectance decreases as soil moisture increases for a given material. The soil temperature method is based on observations which show that differences between daytime and nighttime soil temperatures decrease as moisture content increases for a given material.

In some circumstances, separate reflectance or temperature measurements yield ambiguous data; however, these two methods may be combined to obtain a valid determination of soil moisture. In the combined approach, reflectance is used to estimate low moisture levels, and thermal inertia (or thermal diffusivity) is used to estimate higher levels.

The reflectance method appears promising for surface estimates of soil moisture, whereas the temper-

ature method appears promising for estimates of near-subsurface (0 to 10 cm) soil moisture.

### Notes:

1. The following documentation may be obtained from:

National Technical Information Service  
Springfield, Virginia 22151  
Single copy price \$3.00  
(or microfiche \$0.95)

Reference: NASA TM. X-62,343 (N74-19982),  
Use of Visible, Near-Infrared, and Thermal Infrared Remote Sensing to Study Soil Moisture.

2. No additional documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer  
Ames Research Center  
Moffett Field, California 94035  
Reference: B75-10026

### Patent status:

NASA has decided not to apply for a patent.

Source: Maxwell B. Blanchard  
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