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Applications of HCMM Satellite Data

to the Study of Urban Heating Patterns

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16. Abstract

The first analyses of the Washington, D. C. area has been completed in which our method was employed to determine the surface energy balance, moisture availability, and thermal inertia. Further analyses of the Clarksville, Tennessee area during project STATE were completed. To test our newly-operational interactive system, a temperature study of the Central Pennsylvania Barrens was performed.

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Figure 2. Technical Report Standard Title Page

Introduction

The first analyses of the Washington, D.C. area have been completed in which our method was employed to determine the surface energy balance, moisture availability, and thermal inertia. Further analyses of the Clarksville, Tennessee area during project STATE were completed. To test our newly-operational interactive system a temperature study of the Central Pennsylvania Barrens was performed.

Analyses

The Washington, D. C. case (for June 11, 1978) were the first analyses we have performed with the aid of our interactive mini-computer facilities. The results of this case, though more easily obtained because of the improved data processing capabilities, closely resembled those obtained for St. Louis and Los Angeles -- Bowen ratios of about 1 and a moisture availabilities of less than 0.3 over the inner city and Bowen ratios of about 0.1 and moisture availabilities approaching 1.0 over densely vegetated regions. The same results were obtained for a Clarksville case (Aug. 1978) although in that study our intention was to compare the satellite-derived flux values with those obtained by a NOAA aircraft instrumented to measure vertical eddy flux of heat and water vapor by the eddy correlation technique. Unfortunately, agreement between aircraft and satellite fluxes, except for the magnitudes of the evaporative fluxes, was poor. However, we regard the satellite method as being more reliable than that of the aircraft. The Clarksville analyses, including a discussion of the effect of differing surface heat flux values on plume dispersion from a power plant, will be included in a MS Thesis by Don DiCristofaro, to be completed this fall.

A study of the Pennsylvania Barrens was carried out, partly because of prevailing interest in the subject at Penn State, but also as a test of the mini-computer system in being able to rapidly extract working area from an

image and to obtain accurate ground control points over relatively undifferentiated terrain. An enlarged portion of our analyses area, for the night of 11 June, 1978 (Fig. 1), shows the pronounced cold region just to the west of State College. Relatively high temperatures existed over the higher elevations and over the urbanized area of State College. Cold temperatures are found over the Nittany Valley and, of course, over the Barrens. Two minima appear over the Barrens in Fig. 1. The screen level (1m) surface temperature reported at the Barrens instruments shelter was 1.5°C at the time of the satellite passover, in close agreement with the satellite temperature of 2.8°C at the site and 1.5°C at a location slightly farther to the south.

Facility Development

The Initial phase of our interactive computer facility has been completed. We now have the capability of performing all our satellite data processing analyses on a terminal connected to DEC 11/34 mini-computer and Grinnell image processor. We are also completing efforts to analyze our final products on the department's flatbed plotter, which is connected to the mini-computer. Plans are also being implemented to streamline the boundary layer model and to include that component and its auxiliary programs as part of the mini-computer package.

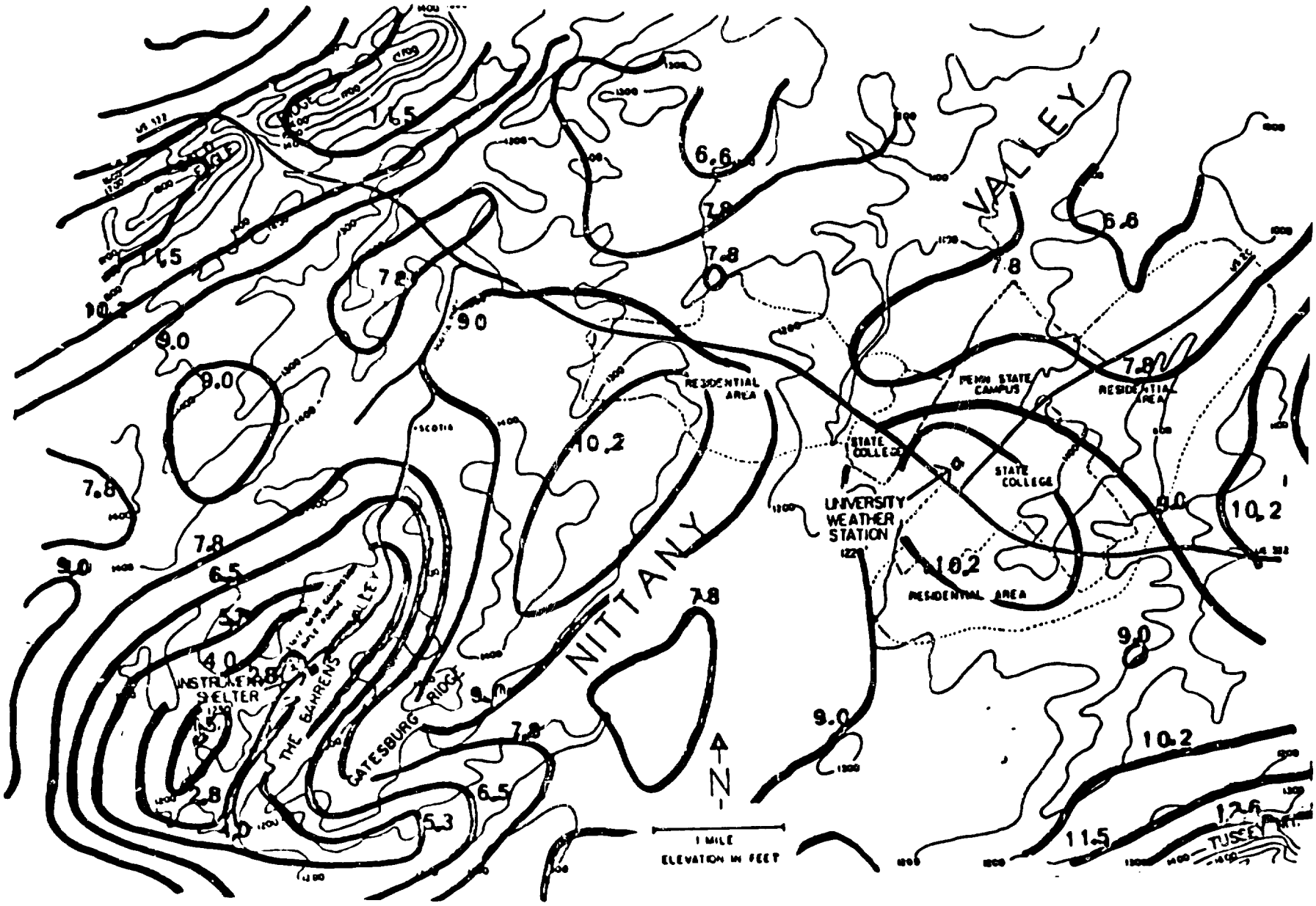

Fig. 1 Surface temperature analyses (°C) for the Barrens area of Central Pennsylvania, approximately 0230 EST, 11, June, 1978, as determined from the HCMM satellite.