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FIRE EXTENDED TIME/LIMITED AREA OBSERVATIONS AT PALISADES, NEW YORK

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Downwelling shortwave and longwave irradiation are being continuously monitored at Palisades, New York as part of the First International Satellite Cloud Climatology Project (ISCCP) Regional Experiment (FIRE) Extended Time/Limited Area initiative. In addition, fisheye (180^{o}) sky photographs are taken at the times of NOAA 9 and Landsat satellite overpasses on select days, particularly when cirrus clouds are present.

Measurements of incoming shortwave (0.28-2.80µm) hemispheric and diffuse, hemispheric near infrared (0.7-2.80µm) and downwelling hemispheric infrared (4.0-50.0µm) irradiation have been made from a rooftop location on the grounds of the Lamont-Doherty Geological Observatory since December 1986. The three Eppley Precision Spectral Pyranometers and the Eppley Pyrgeometer used to measure these variables were calibrated with Colorado State University instruments at Madison, Wisconsin as part of the FIRE Intensive Field Observations project in October 1986. They were recently recalibrated by the Eppley Laboratory. Pyrgeometer output contains an adjustment for body temperature but not for dome temperature. Data are transmitted to a Campbell CR-21 Digital Recorder, where one minute averages of ten second samples are stored and subsequently dumped to a cassette recorder. Using a Campbell C-20 Cassette Interface, these data are transferred to an Apple Macintosh computer for analysis and for archiving on floppy disks.

In addition to the raw irradiances collected, variables derived from these data are generated and stored. These include: 1) the ratio of near infrared irradiation to visible irradiation and 2) the fraction of the full shortwave irradiation which is diffuse; and will soon include: 3) shortwave (sw) transmissivity (equation 1) and 4) optical depth in the shortwave (equation 2).

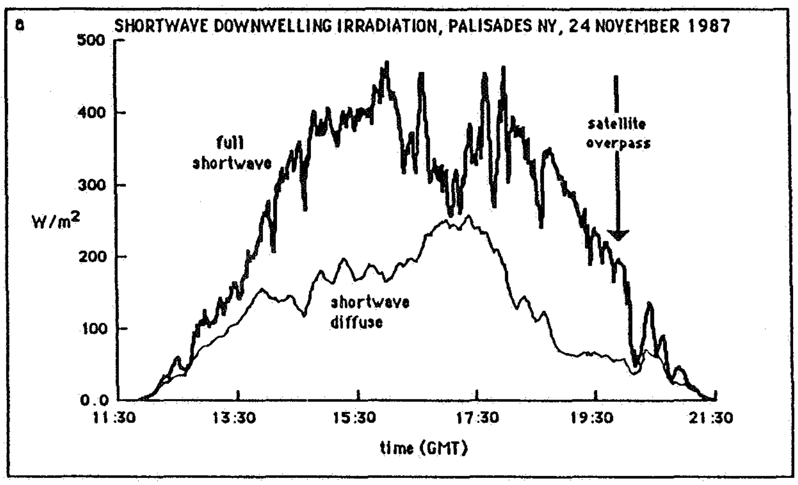
$$\text{transmissivity} = \frac{\text{sw irradiation at the surface}}{\text{incoming sw at top of atmosphere}} \qquad (1)$$

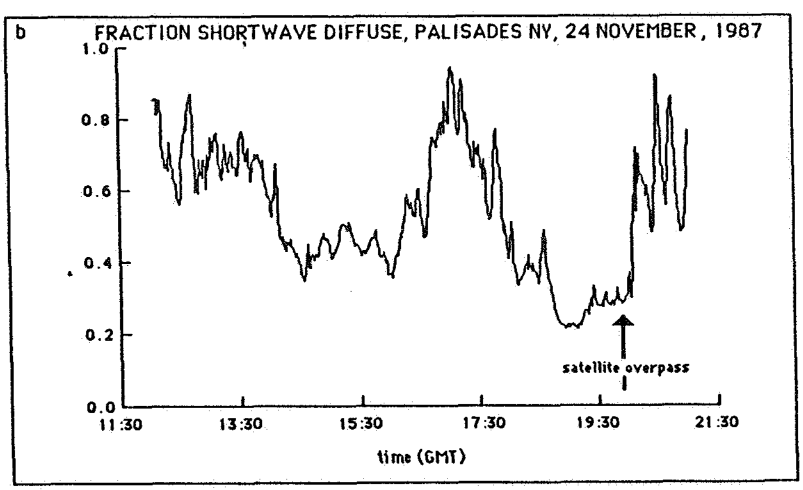
$$\text{optical depth} = \text{cos zenith angle} \quad \ln \quad \frac{\text{top of atmosphere insolation}}{\text{sw irradiation - sw diffuse irradiation}} \qquad (2)$$

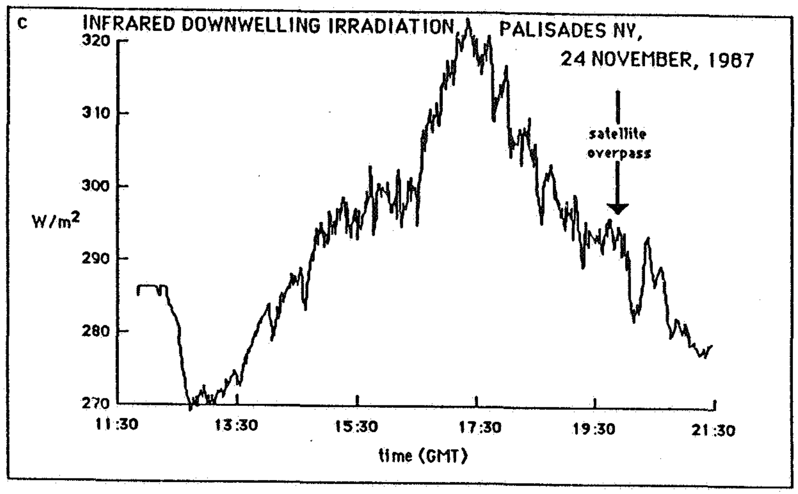
Sky photographs are taken with an Olympus OM2-N 35mm camera and are timed to be coincident with overpassing NOAA 9 and Landsat satellites. Palisades is within the field of view of the NOAA 9 daily in the middle to late afternoon. The satellite viewing angle is within 45^{o} of nadir over Palisades on approximately half of the passes.

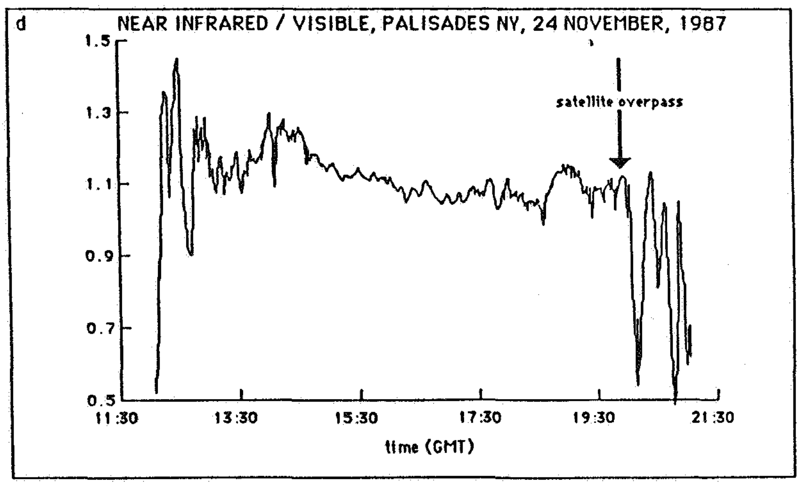
Graphs showing measurements of irradiances and several of the derived products are shown in figure 1 for November 24, 1987. Cirrus of varying thickness was present throughout the day. Excluding the 16:30-18:30 GMT interval, this is indicated by the rough nature of the temporal march of irradiation, yet its relatively high values, from the relatively low infrared irradiation, from the high near infrared to visible ratio and from the shortwave diffuse ranging between approximately 0.2 to 0.7. Clouds were lower and thicker during the mid-day period (16:30-18:30), as seen by rises in the shortwave diffuse and the downwelling infrared. The lack of a noticeable decrease in the near infrared to visible ratio and the continued presence of 10-20% direct radiation indicates that these clouds were not opaque. Compare this to a thicker stratus event at approximately 20:10, when the near infrared to visible ratio fell significantly. This thick patch of stratus apparently covered only a small region near the sun, as some direct radiation, or at least radiation close to the sun's direct beam continued to be recorded.

Figure 1 a-d. Irradiances and associated atmospheric variables on November 24, 1987 at Palisades, New York. Time is GMT, which is local time plus 5 hours. Local noon is at 16:45. See the text for a description of sky conditions.



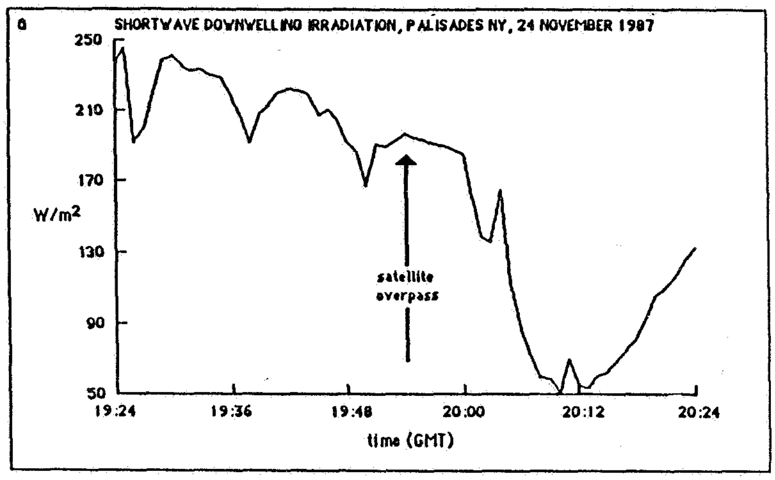


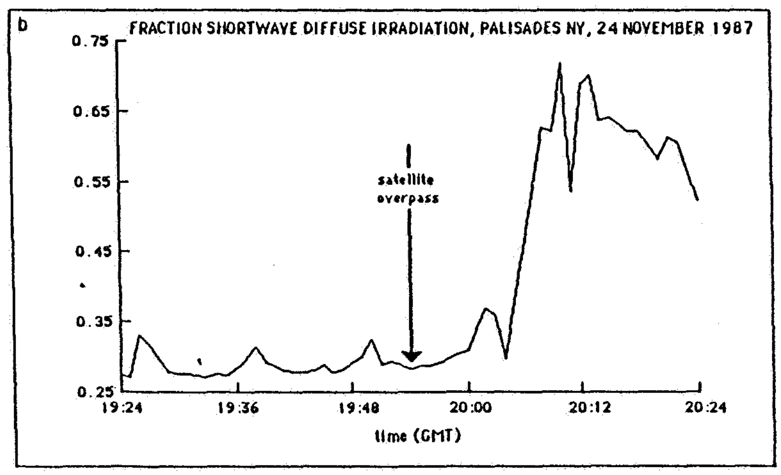


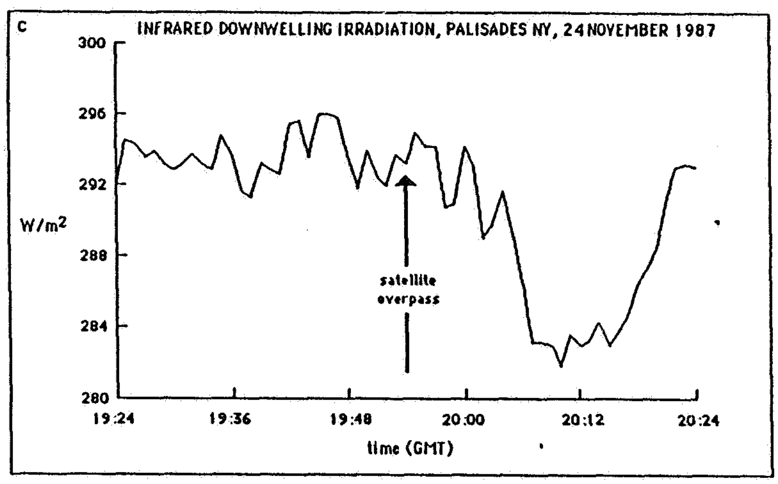


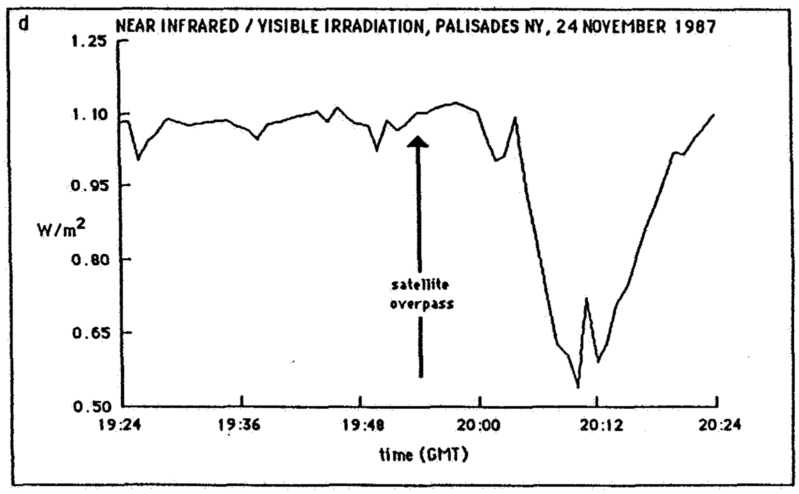
Details of conditions for 30 minutes on either side of the NOAA 9 overpass on the 24th are shown in figure 2. The satellite image was taken with cirrus over the station and in the direction of the sun. About ten minutes after the overpass, the previously discussed thick stratus passed in front of the sun. At this point, in a late-afternoon situation such as this, one would expect the shortwave signal to decrease and the infrared to remain relatively stable at first and later increase as the cloud passed from west to east over the station. In this case, however, the shortwave and infrared decreased simultaneously. This suggests that the approximate 10 W/m^2 decrease in the infrared was the result of dome cooling in the absence of direct shortwave insolation. Also, the lack of an increase in the infrared to values greater than those preceding its decrease suggests that either: a) this cloud never passed directly over the station or b) if the cloud passed overhead it had a high base. This situation is indicative of the difficulties inherent in looking at station records in detail with respect to both time and absolute irradiances.

Figure 2 a-d. Detailed view of a portion of figure 1 around the time of the NOAA 9 overpass.









Analysis of the Palisades data has only recently begun. Among the tasks to be performed include:

1) Expansion of the efforts to recognize cirrus from non-cirrus clouds and clear skies using irradiation data. This was begun with data gathered at Wausau, Wisconsin during the FIRE Cirrus Intensive Field Observations project (cf. Robinson and Frei, this volume).

2) A study of cloud space/time statistical structures.

3) Comparison of surface observations of shortwave irradiance taken at satellite overpass times to surface irradiances derived from satellite data.

4) Validation of ISCCP satellite cloud retrieval techniques.

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