

PICTURE OF THE MONTH

Monitoring Air Quality from Satellites

FRANCES C. PARMENTER

NOAA/NESS, Applications Group, Washington, D. C. 20233

14 March 1977

Data from the operational geostationary satellite (GOES 1) can be effectively used to delineate and monitor large smog or smoke areas (Ernst, 1975; Parmenter, 1971); similarly, meteorological systems that will improve local air quality can be tracked. Suspended particulate matter frequently appears as milky gray areas, or bands, which are best observed in early morning and late afternoon visible satellite imagery. If the lower atmosphere is moist, these bands of smoke or haze will be easily detectable through the day; their presence can also be instrumental in determining where localized afternoon convection will occur.

In the example presented here, a large area of smoke (A,B,C,D Fig. 1) produced by extensive forest fire activity in Ontario and Quebec had drifted eastward

and was poised on the eastern border between the United States and Canada. Clouds and rain associated with a low pressure area (E) were moving eastward across the northeastern states south of the smoke area. A stationary front was analyzed from S to S' in eastern Canada. At 1200 GMT winds at the surface were southwesterly throughout the northeastern states, but at 850 mb (Fig. 2) winds were north to northwesterly near B and westerly at C. Synoptic reports indicated that the haze layer was basically aloft with the top of the layer at ~8000 ft.

The next view (Fig. 3) shows the smoke 3 h later. The smoke in the vicinity of B and C appeared to be steered by the 850 mb winds. By 1500 GMT Rochester, N. Y. (R) reported a thin obscuration, visibility 6 mi in haze, with haze covering 0.2 of the sky. This hazy

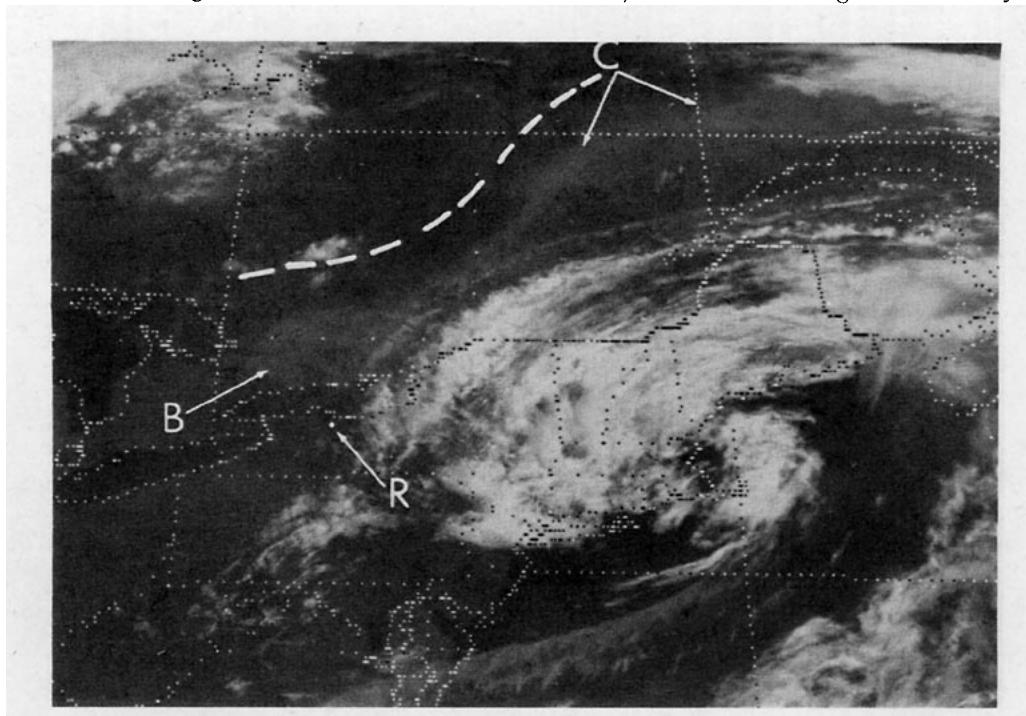


FIG. 1. GOES 1 visible data, 2 km resolution, 1130 GMT 7 June 1976.

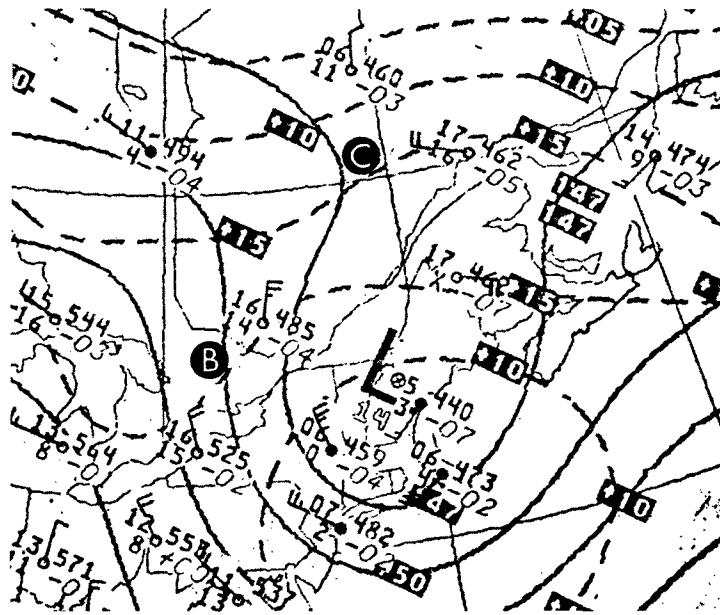


FIG. 2. NMC analysis, 850 mb, 1200 GMT 7 June 1976.

area progressed southward across Lake Ontario and the Adirondacks into Pennsylvania in the succeeding pictures (Figs. 4-6). Remarks of hazy conditions aloft were carried by a number of reporting stations in this area by the end of the day (Fig. 7). Obscured skies were reported along the Lake Ontario and Lake Erie shorelines where the sinking return flow circulation of the lake breeze was advecting the haze inland. In

south central New York, increased stability due to the building ridge to the west was causing worsening visibilities in this region.

The haze in central New York remained quite coherent and drifted southward during the next day passing over the western portions of the mid-Atlantic states.

The portion of the smoke and haze plume (C Figs.

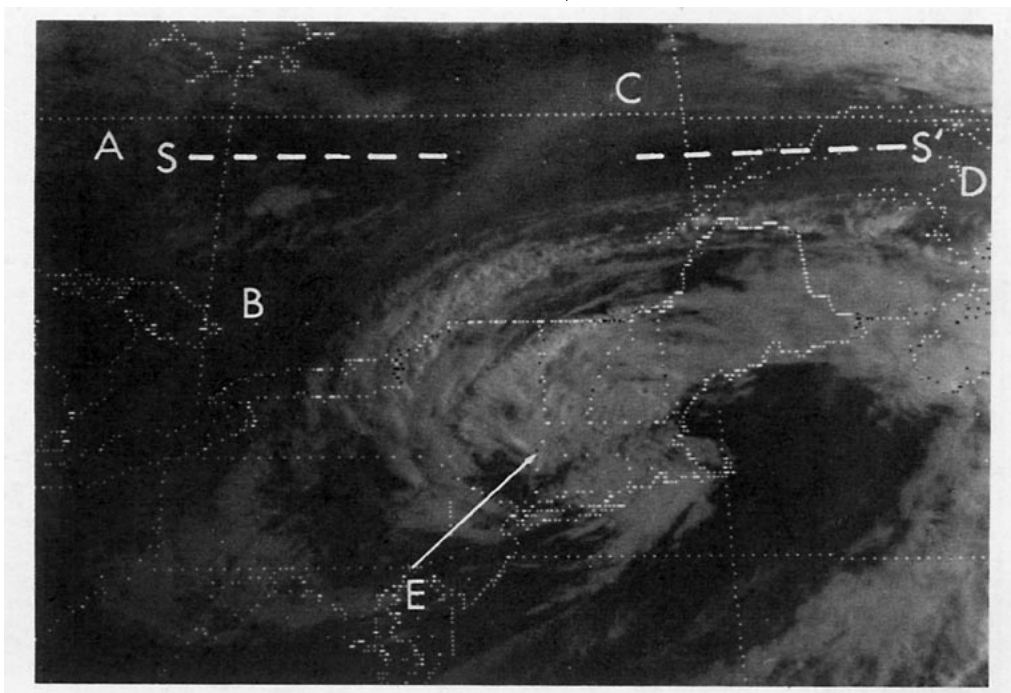


FIG. 3. GOES 1 visible data, 1430 GMT 7 June 1976. Dashed line indicates haze position at 1130 GMT.

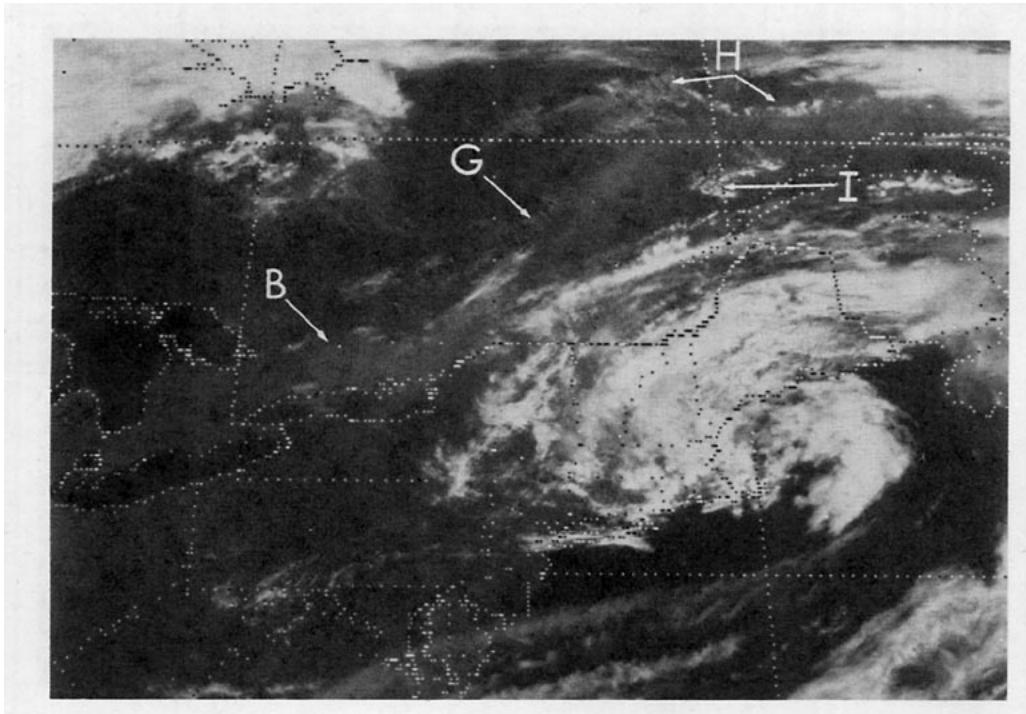


FIG. 4. GOES 1 visible data, 1630 GMT 7 June 1976.

1-3) over easternmost Canada was located in a more moist, unstable environment. This haze band began to move southeastward between 1130 and 1430 GMT (Figs. 1 and 3) and then became nearly stationary

between the upper-level easterly (Caribou, Me.) and westerly (Baie Comeau, Que.) flows (Fig. 2). Differential heating of the surface, resulting from the shielding effect of the haze and the greater heating

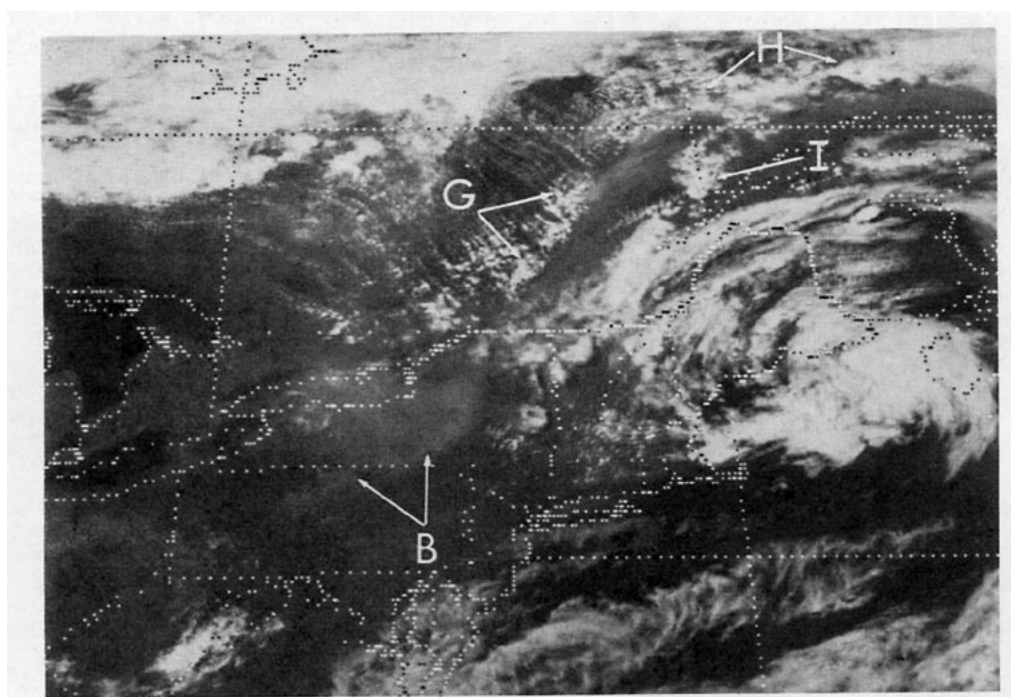


FIG. 5. GOES 1 visible data, 2030 GMT 7 June 1976.

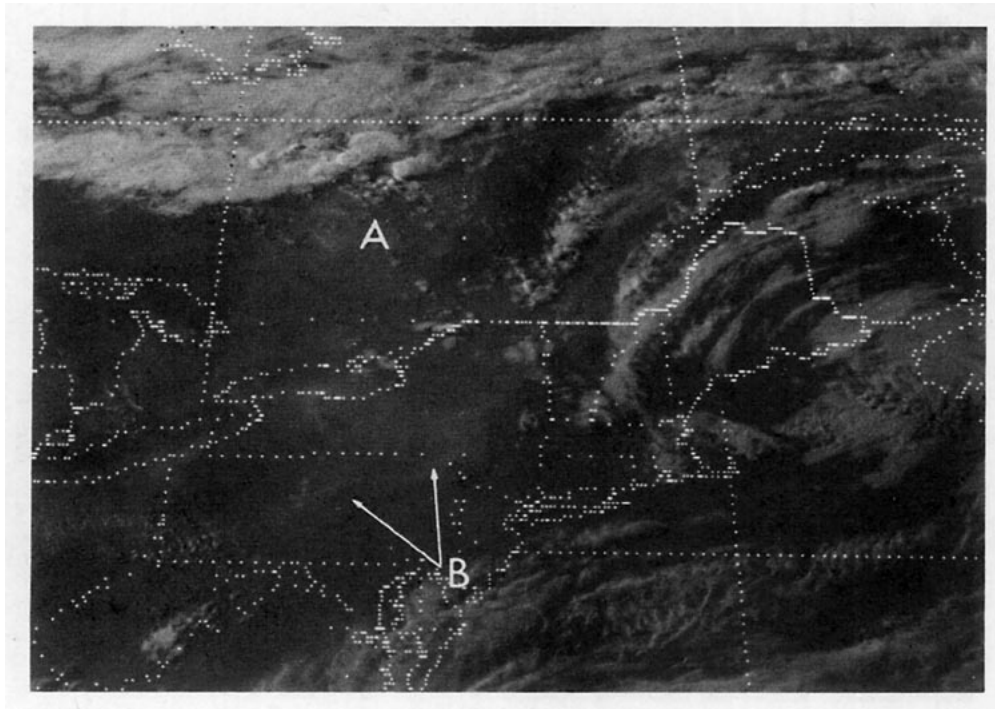


FIG. 6. GOES 1 visible data, 2230 GMT 7 June 1976.

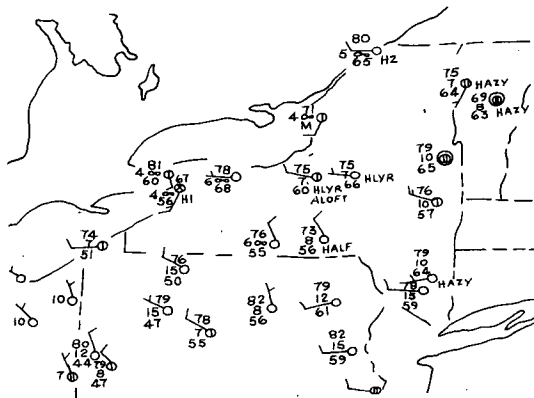


FIG. 7. Surface observations, 2300 GMT 7 June 1976.

of the adjacent land, served to create a situation analogous to a sea breeze regime. As a result, clouds formed along the edges of the haze band G,H,I (Figs. 4, 5). Because of the poor visibility aloft, these convective clouds present a serious hazard to low-level aircraft operations. Thus the delineation of the edge of the haze band provides a useful tool for the forecasting of local, summertime convection (Parmenter, 1976).

REFERENCES

- Ernst, J. A., 1975: A different perspective reveals air pollution. *Weatherwise*, 28, 215-216.
- Parmenter, F. C., 1971: Picture of the Month: Smoke from slash-burning operations. *Mon. Wea. Rev.*, 99 684-685.
- , 1976: Effect of the Great Lakes on weather in the surrounding states. *Preprints Sixth Conf. Weather Analysis and Forecasting*, Albany, N. Y., Amer. Meteor. Soc., 246-251.