Picture of the Month

From Pictures to Winds

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From Hadley's (1735) pioneering research on the configuration of the trade winds, continuing through the modern work of Riehl (1954) and others, scientists have sought to expose the geophysical mysteries of the tropics. Beginning with modest early cruises like that of the *Meteor* (Von Kühlbrodt, 1928) and continuing to the recently concluded BOMEX expedition (de la Moriniere, 1972), meteorologists have aperiodically collected and analyzed unique sets of discontinuous information from the data-sparse tropical oceans. Concurrently these experimenters have longed for a technique of routine data sampling which would drive the best forecast models of the day. The age of the weather satellite might soon provide such a day. With April 1974's scheduled launch of the United States' Atlantic-viewing SMS-GOES, the first of an internationally funded, globe-girdling network of geosynchronous satellites will be in place. Simultaneous round-the-clock

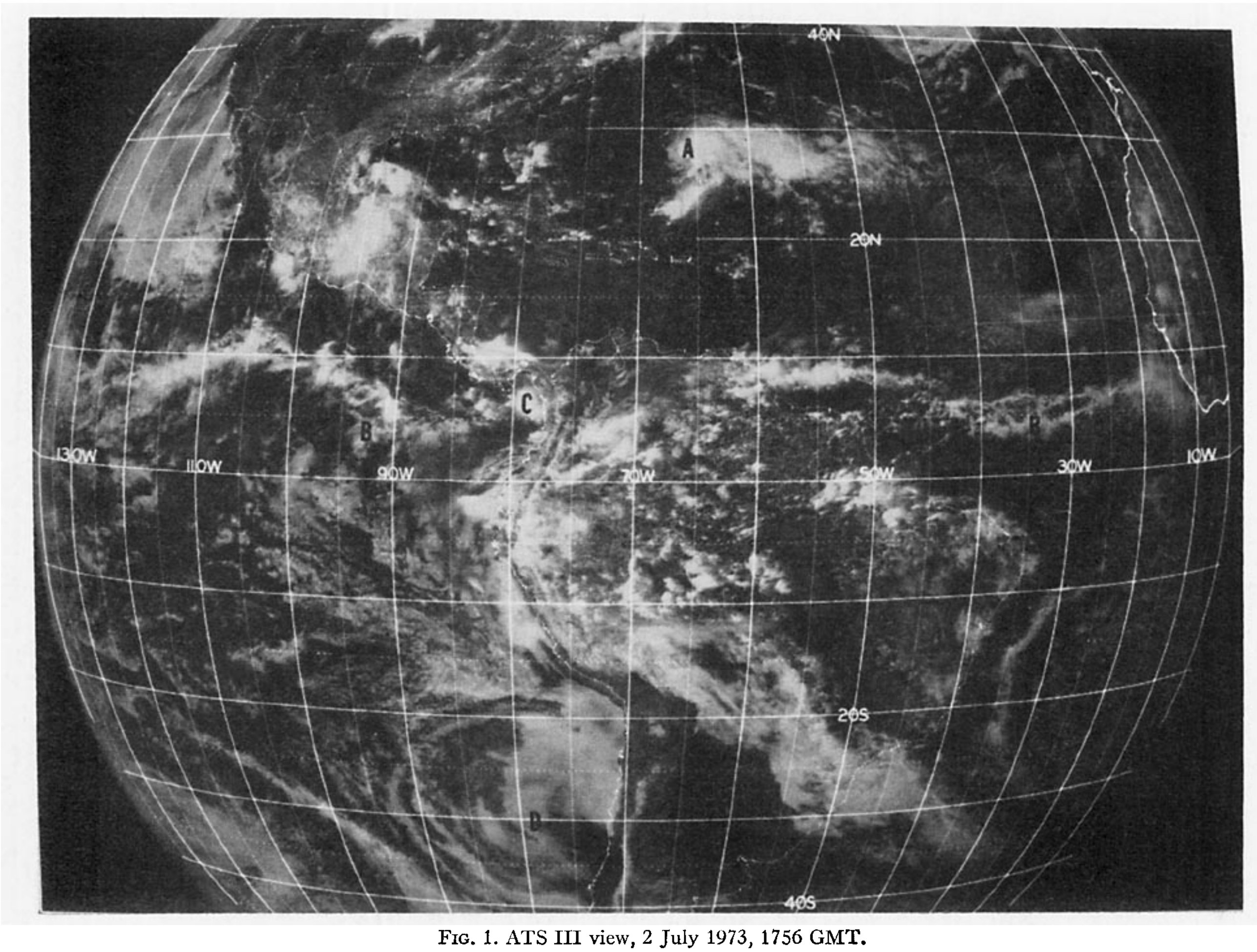

FIG. 1. ATS III view, 2 July 1973, 1756 GMT.

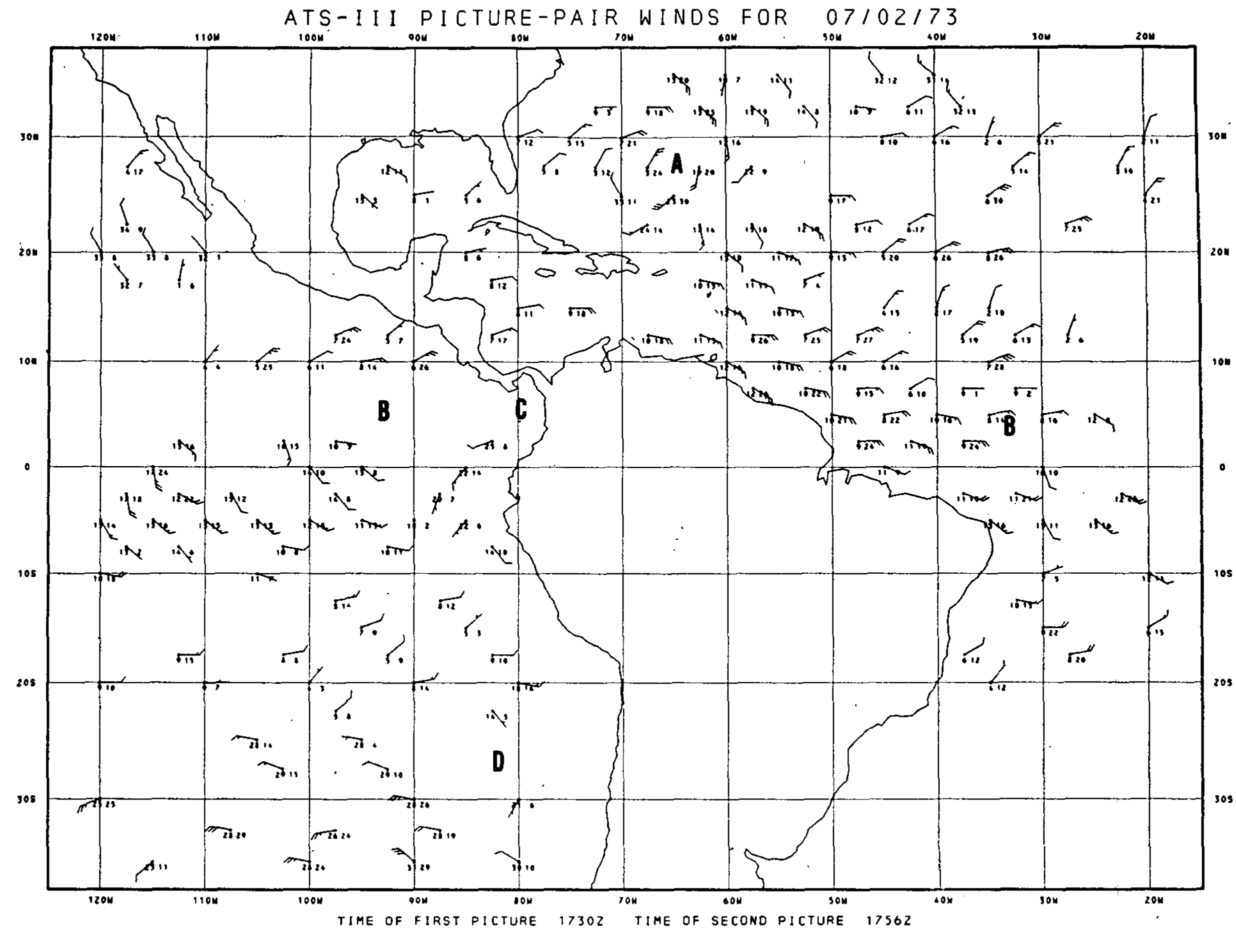

FIG. 2. ATS III "picture pair" winds, 2 July 1973.

observations in both visible and infrared spectral ranges will then be provided to scientists worldwide.

This month's picture (Fig. 1) was taken 2 July 1973 by the current geosynchronous satellite (ATS-3). Figure 2 is a display of some of the information a numerical analysis of the picture has yielded. The tropical flow chart (Fig. 2) depicts the edited output of the computer-calculated "picture-pair" low-level wind analysis valid at the same hour as Fig. 1. This product is operationally generated at the National Environmental Satellite Service (NESS) for users, including the National Meteorological Center (NMC), about 1300 GMT and 1800 GMT daily. To produce wind vectors such as those depicted in Fig. 2, a cross-correlation technique is used (Leese, 1973; Bradford *et al.*, 1972). Two sequential ATS pictures are precisely matched geographically, and the over-ocean areas are numerically scanned for cloud displacements from which wind vectors are inferred. The height of the presently useable winds is classified as "low-level." The 850-mb level is considered the most representative standard level (Hubert and Whitney, 1971).

Many features in Fig. 1 are evident in the flow patterns of Fig. 2, which is displayed in standard meteorological notation: DD—direction in tens of degrees (below and to the left of the station circle); VV—speed in knots (below and to the right). In the north central portion of Fig. 2, tropical storm Alice can be seen deforming the semipermanent anticyclonic flow pattern of the mid-Atlantic high (A). Further southward between 5N and 10N, the classical pattern of hemispheric trade confluence into the intertropical convergence zone is easily noted (B). Monsoonal westerlies can be seen converging into the thunderstorm cluster blanketing the Gulf of Panama (C), while weak circulations in the immense stratocumulus fields over the cold waters off Chile adequately define one center in the tropical South Pacific ridge (D). During the operational routine the machine-edited vectors, displayed as in Fig. 2, are next transmitted via photo-facsimile to the Analysis Branch of the NESS. A satellite meteorologist screens each vector prior to its final teletype transmission to worldwide users.

Some current experiments at the NESS have concentrated on attaching pressure/heights to these wind vectors. Present techniques match time- and spacecoincident infrared data from the polar-orbiting NOAA-2 satellite with the sequential video frames from ATS-3. Algorithms employing the NESS sea-surface temperature field as background determine representative temperatures of the same cloud targets used in the displacement measurement. Pressure/heights corresponding to cloud temperatures for each target are then inferred by interpolation from the NMC's seven-level tropical pressure analyses. Results from recent efforts have provided exciting previews of potential capabilities using dual-channel data from SMS-GOES.

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