

## PICTURE OF THE MONTH

### Hurricane Twins over the Eastern North Pacific Ocean

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Visible and infrared (IR) pictures (Figs. 1-3) from the Very High Resolution Radiometer (VHRR) aboard the NOAA-3 orbiting satellite show hurricanes Ione (lower left) and Kirsten (upper right) over the tropical eastern North Pacific Ocean on the morning of 24 August 1974.

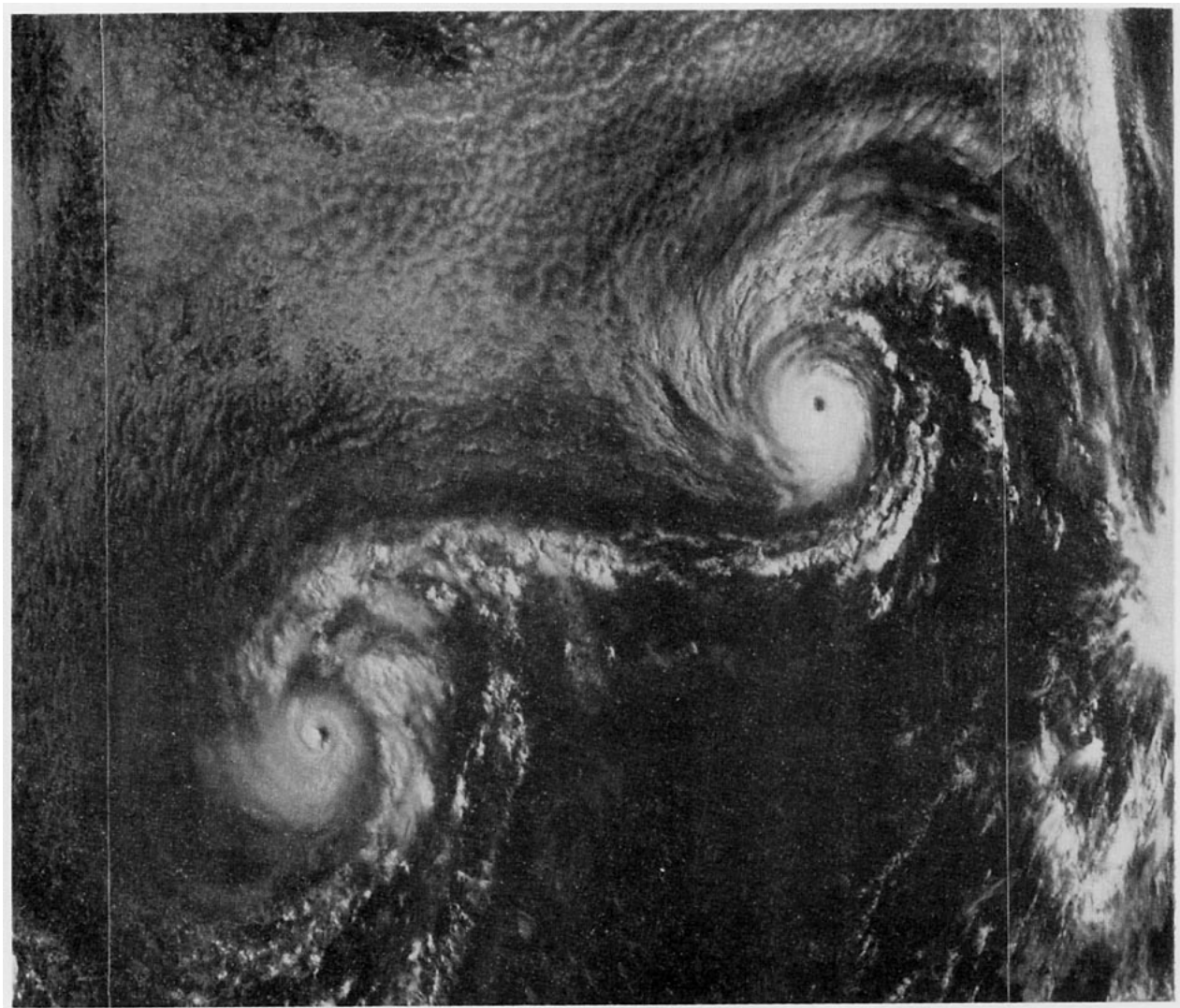


FIG. 1. NOAA-3 visible range VHRR photograph, taken at approximately 1749 GMT 24 August 1974, shows hurricanes Ione (left) and Kirsten (right).

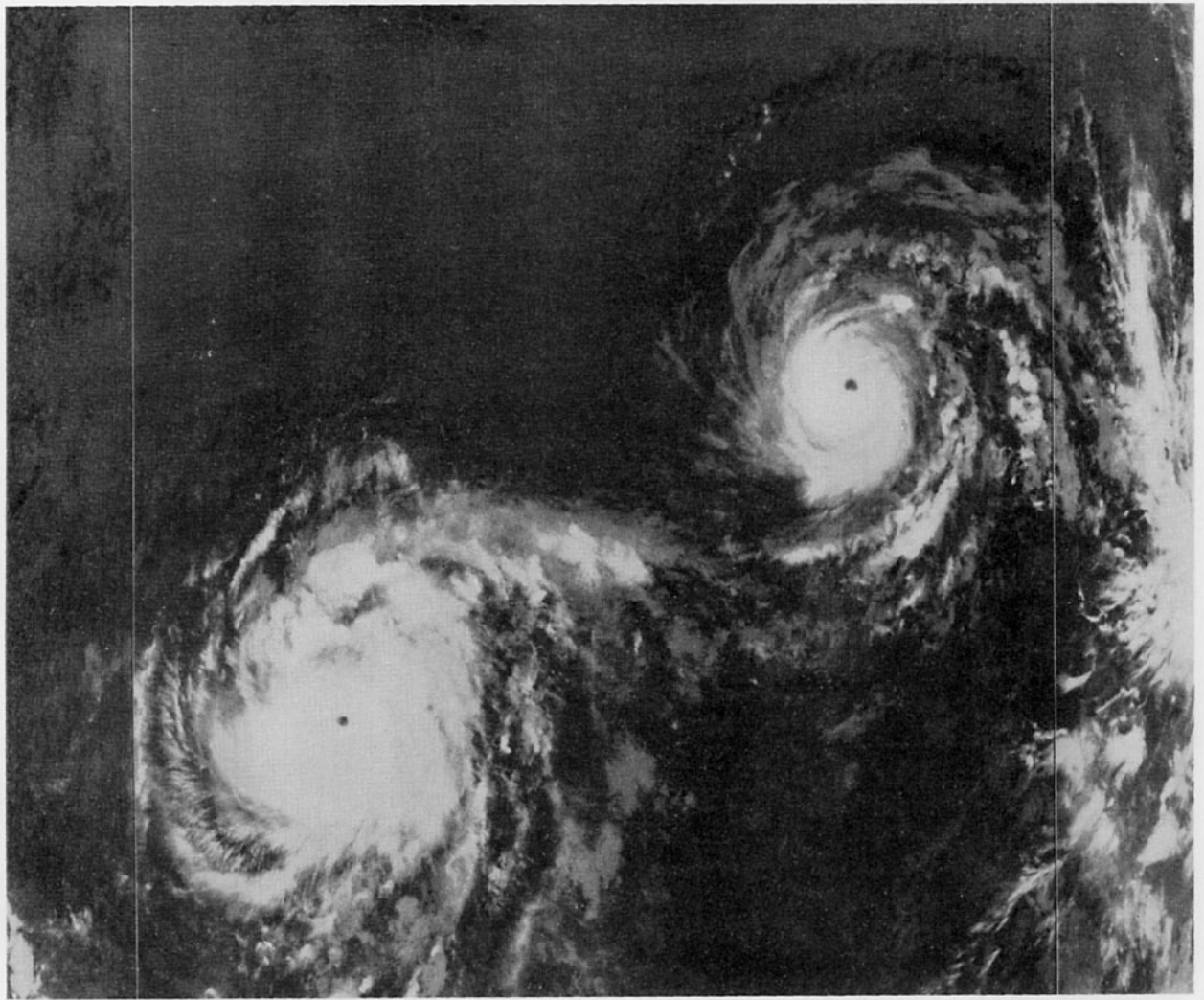


FIG. 2. NOAA-3 infrared range VHRR photograph taken at same time as Fig. 1.

At picture time, 1749 GMT, hurricane Ione was located at  $13.0^{\circ}\text{N}$ ,  $141.5^{\circ}\text{W}$  and was moving west at 8 kt, with maximum sustained winds of 85 kt estimated by the satellite analysis technique of Dvorak (1973, 1974). Ione had developed into a tropical depression (sustained winds of 33 kt or less) by 1800 GMT 19 August when located at  $13.0^{\circ}\text{N}$ ,  $124.5^{\circ}\text{W}$ . This tropical depression moved westward and attained tropical storm intensity (34–63 kt) on 20 August and hurricane intensity on 23 August.

Hurricane Kirsten was located at  $16.4^{\circ}\text{N}$ ,  $130.6^{\circ}\text{W}$  at picture time and was moving west northwest at 5 kt, with maximum sustained winds of 65 kt estimated by satellite analysis. Kirsten officially became a tropical depression at 0600 GMT 22 August when located at  $13.6^{\circ}\text{N}$ ,  $124.0^{\circ}\text{W}$  in the area recently vacated by the developing depression that later became Ione. Kirsten

reached tropical storm intensity on 22 August and hurricane intensity on 23 August 1974.

Of particular note are the well-defined central storm eyes visible in the pictures (Figs. 1–3). In the visible range image (Fig. 1), a shadow and bright reflectance pattern, probably produced by protruding wall clouds, can be seen around the eye of Ione. Kirsten does not show a similar pattern because the satellite was located to the west of it, rather than to the east as was the case with Ione. The position of a cloud feature, with respect to the satellite, influences the solar illumination visible from the satellite. The IR picture (Fig. 2) reveals the warm-core nature and circularity of the two hurricane eyes. In the IR picture processing used in Fig. 2, increasing amounts of IR radiation measured by the satellite radiometer are indicated by progressively darkening shades from white to black. As a result, cold

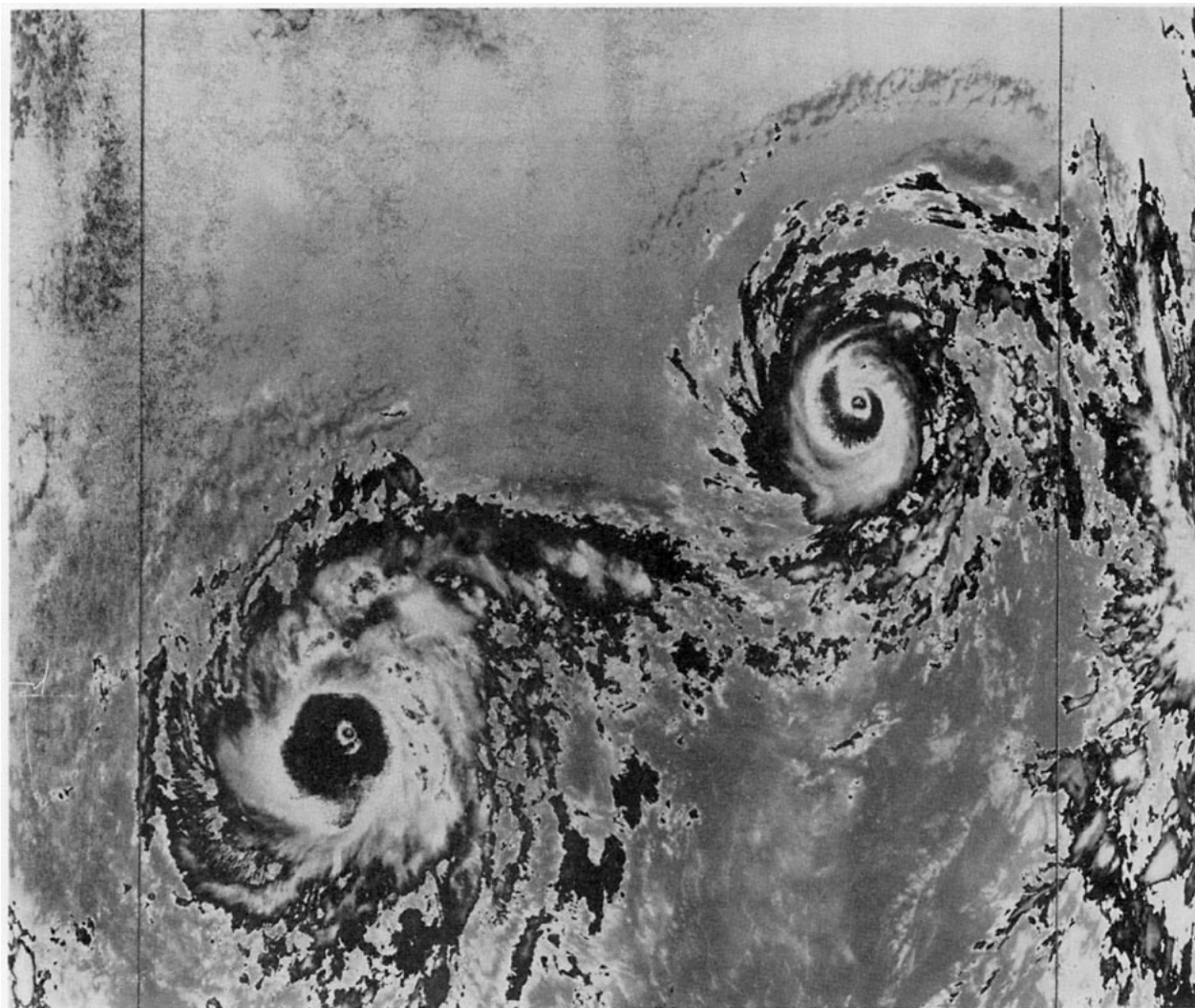


FIG. 3. NOAA-3 infrared range VHRR photograph (specially processed) taken the same time as Figs. 1 and 2.

high clouds and clouds with significant vertical development often appear very white like those seen in the hurricane twins. This feature is evident in the radial outflow of thin cirrus-level cloud seen most clearly on the outer edges of the lower left quadrant of Ione (Fig. 2). Although these outflow clouds are thin as seen in the visible range (Fig. 1), they still appear white and therefore cold in the standard IR range image of Fig. 2. Evidence of outflow aloft, and subsequent subsidence around the periphery of both Ione and Kirsten, can be seen by the partial breakup of the stratus fields,

particularly north and west of the hurricanes.

Figure 3 is a specially processed version of the IR range picture seen in Fig. 2. It was produced by using the standard white-through-black shade scale three separate times as amounts of measured IR radiation increased. The desired effect of this process was to separate artificially the cold white clouds seen in Fig. 2 into more distinct degrees of coldness so that cloud banding and wall cloud features are more readily discernible.

Hurricanes Ione and Kirsten occurred during a very

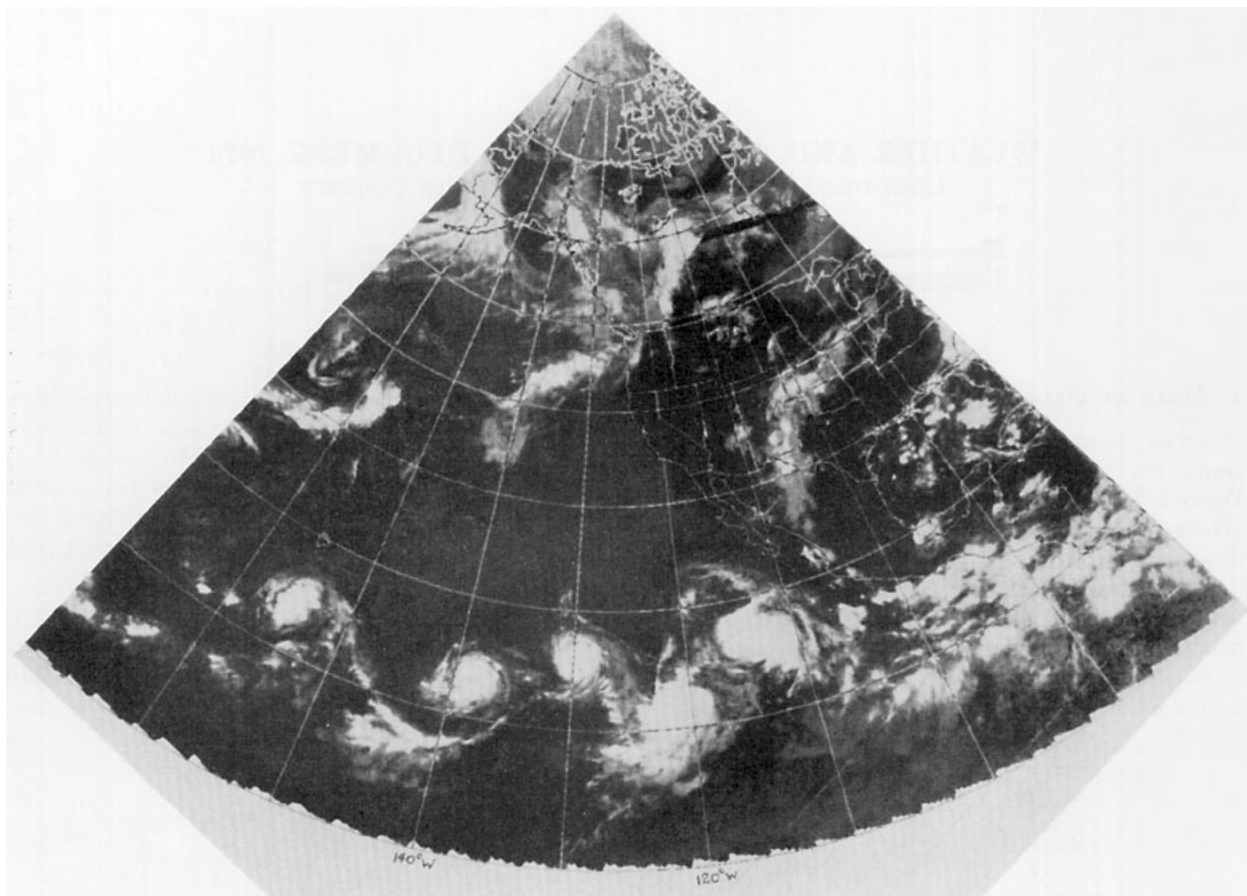


FIG. 4. NOAA-2 daytime infrared-range mosaic taken on 23 August 1974. Five tropical cyclones located between the Island of Hawaii and west coast of Mexico. Left to right: Tropical storm Olive, hurricanes Ione and Kirsten, tropical storm Lorraine, and hurricane Joyce.

active period of tropical cyclone activity over the eastern North Pacific Ocean. Figure 4, a daytime IR range mosaic of passes taken by the polar orbiting NOAA-2 satellite on 23 August 1974, reveals the extraordinary existence of five ongoing tropical cyclones including Ione and Kirsten. As suggested by Sadler (1964), the tropical cyclone climatology of the eastern North Pacific is only now becoming accurately known through the use of satellite observation as the principal data source.

#### REFERENCES

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- , 1974: Workshop in tropical analysis and forecasting from satellite imagery. Prepublication copy, NESS, U. S. Dept. of Commerce, Washington, D. C., 27 pp.
- Sadler, J. C., 1964: Tropical cyclones of the eastern North Pacific as revealed by TIROS observations. *J. Appl. Meteor.*, **3**, 347-366.