PICTURE OF THE MONTH

Frontal Cloud Movement from Gridded Satellite Imagery

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1. Introduction

The importance of correctly placing latitude/longitude lines (gridding) on meteorological satellite photos, both visual and infrared, cannot be overemphasized. Whether drawn by hand or computer, geographical referencing is a must in labeling satellite imagery. Use of these gridded "space photos" enables one to accurately locate and follow clouds and weather systems.

Since 22,000 mile high geostationary satellites view the earth from static locations above the equator, a

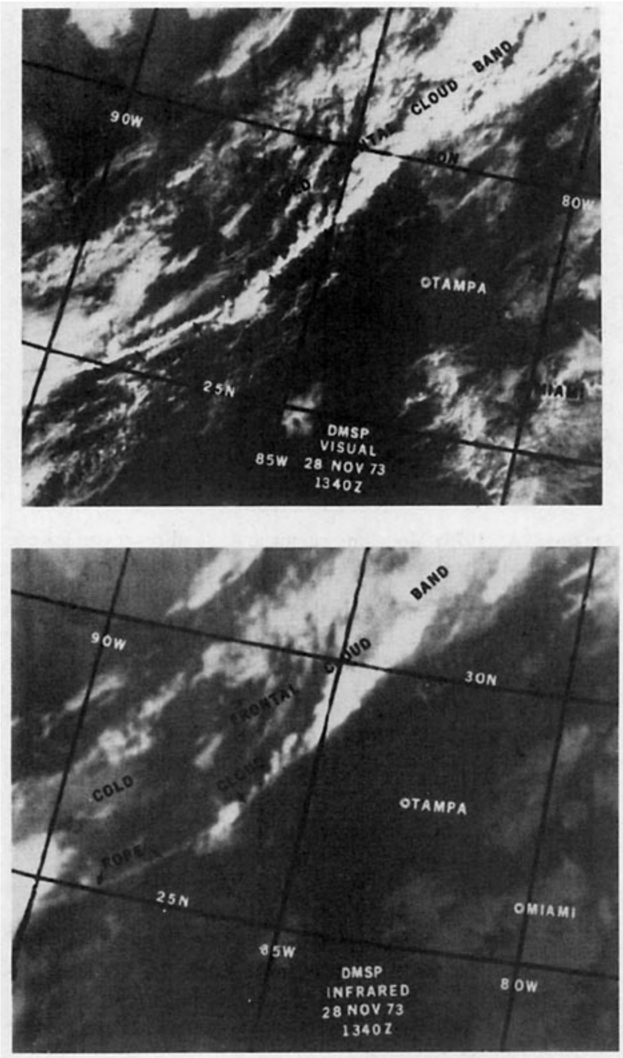

FIG. 1. Visual and infrared position of front, 1340 GMT 28 November 1973.

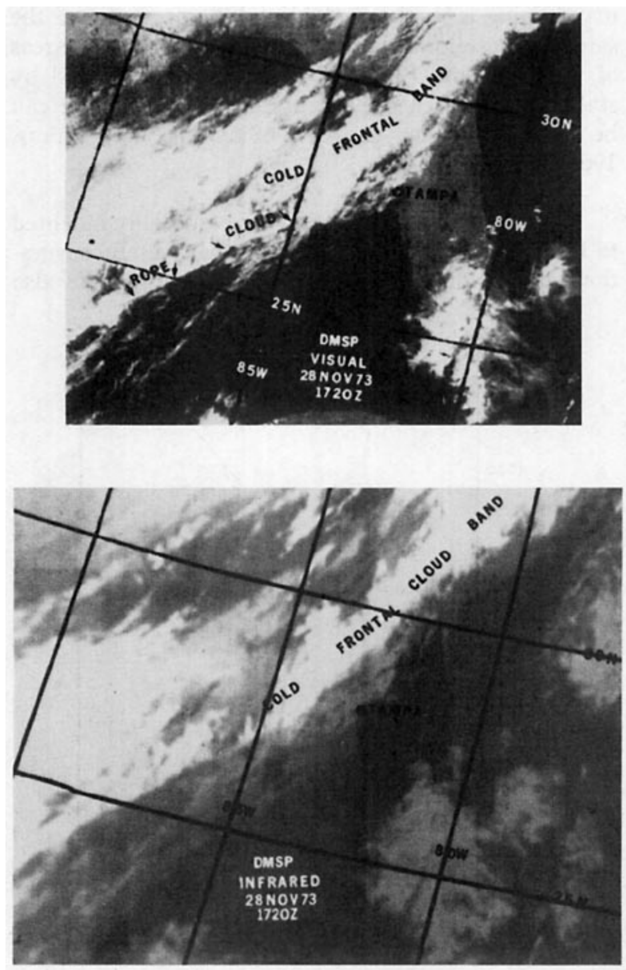

FIG. 2. Visual and infrared position of front, 1720 GMT 28 November 1973.

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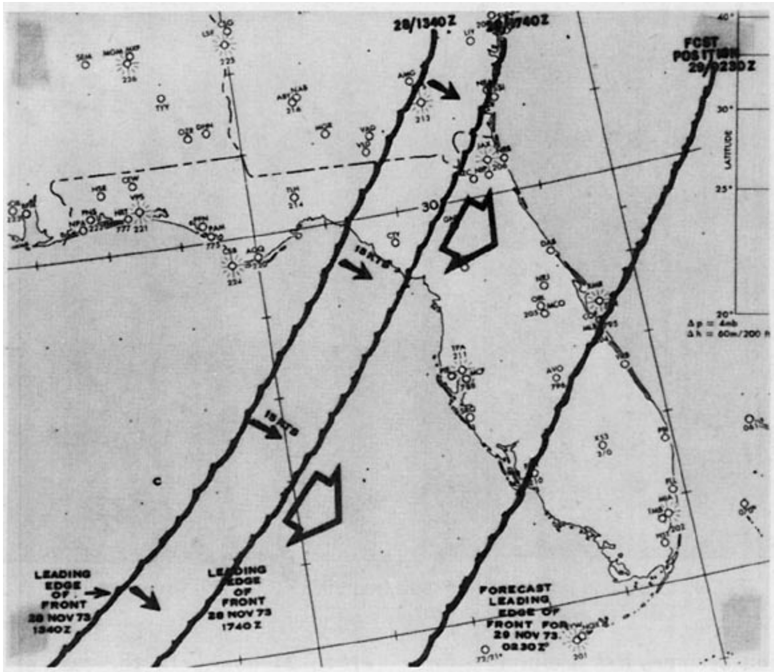

FIG. 3. Positions of leading edges of front depicted in Figs. 1 and 2 with forecast position for 29/0230 GMT.

family of grids allowing for attitude corrections can be superimposed on the frequent earth disk photos. The use of successive disks as movie frames provides a viewer with spectacular observations of cloud movement formation and dissipation over a large portion of the earth's surface. The use of accurate grids insures a smooth motion depiction, eliminating irregular motions due to imprecise geographic location.

Cloud continuity without movie loops from polar orbiting satellites at altitudes from 400 to 900 miles high can be made more useful if proper gridding and interpretation techniques are followed. In this paper, a fast moving cold frontal system, including the near surface position (frontal rope or blue line) is examined and forecast with the use of geographically hand-gridded visual and infrared photos from the Defense Meteorological Satellite Program (DMSP).

2. Discussion

On 28 November 1973, a cold air mass with a frontal cloud system was moving through north central Florida. This front was oriented north-northeast to south-southwest. In Fig. 1, a geographically gridded DMSP visual and infrared photo pair is presented showing this frontal system in the morning hours. The photos were gridded on a light table using a grid under the photo with latitude/longitude lines drawn with the aid of a flexible French curve. While this gridding technique was obvious in the very first books on satellite meteorology (National Environmental Satellite Center, 1965; Russell, 1970), very few weather stations use this method on their real-time received imagery. Additionally, few meteorologists ever *check* or *correct* computer gridded satellite products. Adjusting the computer produced lines is a simple task, but to do so seems to be increasingly rare due to the press of time and increased reliance on computer products.

Because successive polar orbiting satellite sensors view the earth from different locations and angles, placing the latest imagery over past imagery is not as feasible as it is with the discs from geostationary satellites. For optimum continuity, significant weather intelligence from polar orbiting sensors should be transferred to a map, especially in the case of rapidly moving weather systems.

Fig. 2 is a DMSP satellite view of the 28 November frontal system recorded 3 h and 40 min after Fig. 1. A frontal rope cloud is labeled on the visual/infrared data. This rope cloud is the location of the near-surface position of the cold front or the blue line (Janes *et al.*, 1975).

Fig. 3 shows geographic positions of the cold frontal cloud system transferred from Figs. 1 and 2 to a weather plotting chart. The clouds and frontal movement are extrapolated to forecast the future position of the cold front features. Of course, if development or dissipation occurs, or if the system slows, stops or

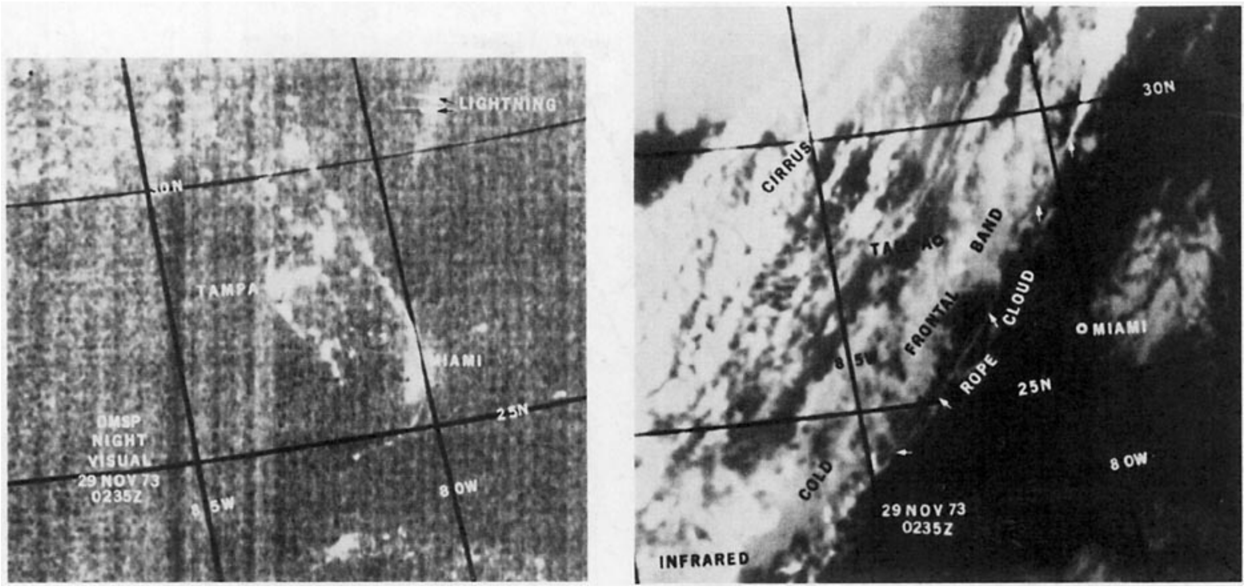

FIG. 4. Visual and infrared position of front, 0235 GMT 29 November 1973.

speeds up, extrapolation becomes less useful as a forecasting tool. However, if enough imagery is available, extrapolation remains a valid short-range technique.

3. Results

Fig. 4 is a visual and infrared view of the frontal system at 0235 GMT 29 November 1973. Comparing Fig. 3 with Fig. 4 shows the accuracy of forecasting significant cloud features such as the leading edge of frontal clouds by using carefully gridded, map-transferred satellite imagery alone. In this instance, extrapolation techniques were successful.

Other systems such as tropical storms, squall lines and convergent areas can be extrapolated accurately up to 24 hours. In the case of conservative systems such as hurricanes and typhoons, continuity and extrapolation from transferred analyzed imagery are valid even longer. Even individual clouds can be monitored and future positions forecast using geographically gridded meteorological satellite data. The key is *accurate gridding* by *geography*.

REFERENCES

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Russell, C., 1970: Some techniques for short-range terminal forecasting. AWS-TR-70-233, Scott Air Force Base, Ill.

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