Satellite

LAND-WATER CLOUD COVER CONTRASTS OVER FLORIDA

by James A. Henry (1) and Steven E. Dicks (2)
Department of Geography
University of Florida
Gainesville, Florida 32611

ABSTRACT

A daytime thermal infrared image from the Heat Capacity Mapping Mission Satellite (HCMMS) reveals unique cloud cover patterns over Florida. The patterns are related to the presence of lakes and to the coastal configuration of the state.

1. INTRODUCTION

Brandli (3) showed examples of GOES visible satellite images that revaled several lakes in Florida, especially Lake Okeechobee in the southern portion of the state, suppressing cumulus cloud formation there and a considerable distance downwind.

Figure 1 shows a Heat Capacity Mapping Mission satellite daytime (1330 LST) thermal infrared image for 13 March 1979 that also shows lee lake effects and several other cloud pattern phenomena. Cooler objects, such as clouds and water bodies, are dark; warmer surfaces are light in tone.

2. DISCUSSION

The less cloudy condition over Lake Okeechobee and downwind (west-northwest) is apparent. The few cumulus clouds that are over the lake probably were advected there. It is this suppression of convective cloudiness over the lake which produces the 15 percent annual reduction of rain there relative to the surrounding land surface (4). Reductions of rain by 53 percent have been measured by radar over shorter time periods. The largest differences occurred when comparing lake rainfall with values of the southeast of the lake. Not only is the cooler lake surface not conducive to convergence and cumulus cloud development, but Pielke (5) has shown through numerical modeling that subsidence and low-level divergence may actually occur over the lake. Figure 1 shows that this suppression of cloud had an influence for at least 39 km to the lee of the lake.

The cloud cover reduction over the Lake Okeechobee area has been quantitatively assessed by Henry and Isaacs (6) using noon DMSP visible satellite data for May-September over three years. A 1-9 percent reduction of cumulus cover over and near the lake was observed for the study period; the lake area is one of the least cloudy areas in the state in the May-September period.

Several other water bodies in the state also reveal an influence on cloud cover. The Tampa Bay area is nearly cloudless. [The small cumulus clouds over it were probably advected from the southeast]. The southeast-northwest oriented string of lakes near the center of the state produces a similarly oriented cloudless area, dispite the fact that the land leeward of each lake is very warm relative to the water. Most of the St. Johns River from Lake George northward to the city of Jacksonville (approximately 135 km) has suppressed most cloud cover. The river south of Lake George is much narrower than the portion north of the lake and has produced no visible effect on the cloud cover.

Another cloud cover feature common in Florida that is revealed on the satellite image is associated with the coasts. Nearly the entire eastern coast and approximately 13 km inland is cloudfree. This distance is roughly equivalent to the distance that the cumulus clouds were advected from the land over the Gulf of Mexico on the west coast of the state before being dissipated. The study by Henry and Isaacs showed that most of the east coast had 16-20 percent cumulus cover at noon, compared with values of 21-30 percent for the central portion of the state; the modal value for the west coast was 21-25 percent. This phenomenon of east coast versus west coast cloud cover has been noted by spring and summer sunbathers, who can, on days like the one in Figure 1, obtain uninterrupted sun on the east coast beaches but not on the west coast. However, on many summer days a strong seabreeze occurs on both coasts; at these times, both sides of the state may have coastal strips that are free of clouds and one may obtain an equal suntan (or sunburn) at either coast.

ACKNOWLEDGEMENTS

We thank the National Space Science Data Center for the satellite data and Paul Stayert for graphics assistance.

FOOTNOTES AND REFERENCES

1. James A. Henry is an Associate Professor in the Department of Geography at the University of Florida. He earned his Ph.D. at the University of Kansas in 1978, and has been at Florida since 1977. His teaching and research are in climatology and remote sensing. He is currently studying urban heat islands using thermal infrared satellite data.

2. Steven E. Dicks is a Ph.D. candidate in the same department. His dissertation research involves the use of satellite data in geomorphological applications.

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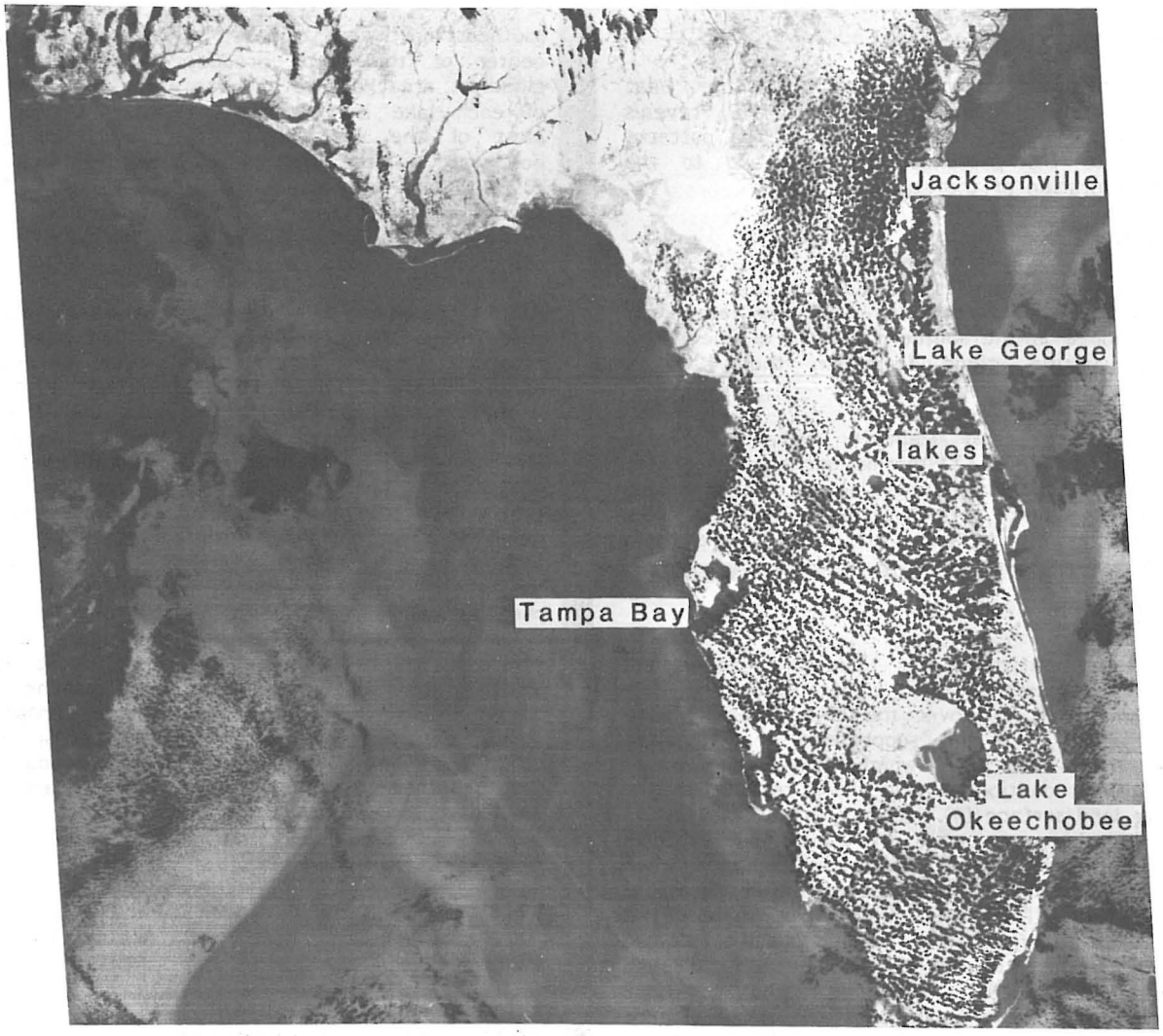

Figure 1. Heat Capacity Mapping Mission daytime thermal infrared for 13 March 1979.