

ABSTRACT

The objective of this project is to better understand the parameters and meteorological conditions necessary for flood and flash flood events in South Florida to better predict when they may occur. The mean meteorological conditions associated with flash flood events in South Florida are determined using flood and flash flood reports from February 1997 - February 2015 Storm Data in the South Florida region. Upper air soundings from site KMFL for all flood and flash flood events are used to create a mean composite sounding. The RAwindsone OBservation (RAOB) program is used to analyze the different soundings and determine what meteorological characteristics and parameters are associated with these events. Events are also broken down into warm season and cool season to better reflect seasonal changes in parameters and atmospheric conditions. Events are then classified based on the synoptic conditions leading to flooding and flash flooding. Anomaly charts are created for various meteorological characteristics to show the anomalies that are present on flood and flash flood event days as compared to the 30 year climatological normal from 1981-2010.

BACKGROUND

Flood & Flash Flood Events in South Florida







FFPI -South Florida

When do Floods and Flash Flood Occur in **South Florida? What Causes them?**





•In South Florida most events occur because of frontal passages and tropical moisture. There is a surge of events in warm season compared to cool season.

Improving Flood & Flash Flood Forecasts at the Miami National Weather Service

Stephen Konarik and Lawrence Kelly



•Wind speed and direction throughout all layers of the atmosphere. •Low LCL levels

•Moist lower levels, upper levels not as influential in flood events

•Precipitable greater than the climatological average; with deviation from average necessary dependent on the season

•Synoptic feature present with a flood event can also affect the sounding. •Soundings vary from eastern and western counties; most noticeable is the surface wind flow direction.

•Air temperature anomaly gradient is distinctly present.

•Low pressure at 500mb is present in the Gulf of Mexico for all flood events.

•Weak easterly flow exists at the surface with a more distinct gradient at higher levels.

- •In meridional winds, an anomalous south flow, which brings plentiful moisture.
- •Precipitable water is on average 8 kg/m² more than climatological average.
- •Relative humidity in the lower levels of the atmosphere is on average 12-18% higher.



Warm vs Cool Season

Season	Warm	Cool
CAPE (J/kg)	1268	401
Freezing Level (m)	4628	4257
Precipitable Water (cm)	5.20	4.02
LCL (m)	310	296

- Warm season flood events are more likely to occur in eastern counties: Broward, Miami-Dade, and Palm Beach. In cool season the western counties, Collier, Hendry, and Glades, see more flood and flash flood events.
- Temperature anomalies are also seen in the different seasons. For warm season cooler than average temperatures are prevalent. In cool season warmer then average temperatures are most common.
- Wind anomalies from surface-500mb include stronger south/southwest meridional flow in cool season. In warm season, a more easterly surface flow is more effective for flooding in eastern counties.

CONCLUSIONS

Flash Flooding occurs mostly in urban areas in the major cities of the forecast area. Synoptic features and atmospheric conditions can help alert forecasters to better understand the potential and risk for flood and flash flood events in the South Florida.

Flash Flooding Checklist WFO Miami

Winds/storm motion

- Slow storm movement (MBE/Corfidi vector)
- 700 500 mb winds < 20 kts
- Upper level divergence
- Easterly near-surface flow
- Wind anomalies

Atmospheric Moisture

- Precipitable water >= 175% normal Winter, 150% Spring/Fall, 125% Summer
- Pronounced moisture gradient
- Moisture anomalies

Synoptic-scale features

- Nearby surface boundary
- Low-level theta-e axis
- 1000-500 mb thickness diffluence Low LCLs
- Poor lapse rates moist adiabatic

• Other parameters

- "Tall and skinny" CAPE
- Warm cloud depth exceeding 3-4 km