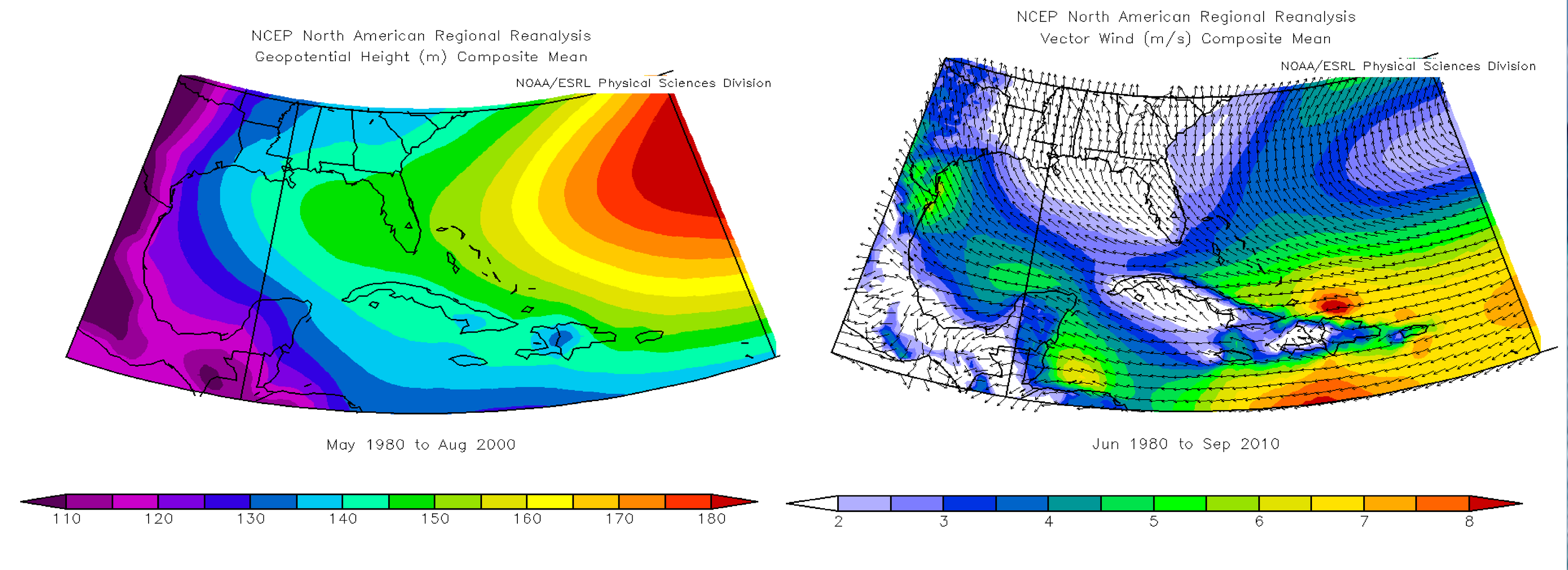
A Wet-Season Rainfall Climatology To Support Airline Arrivals at Key West

Matthew Bloemer and Andy Devanas, WFO Key West, FL

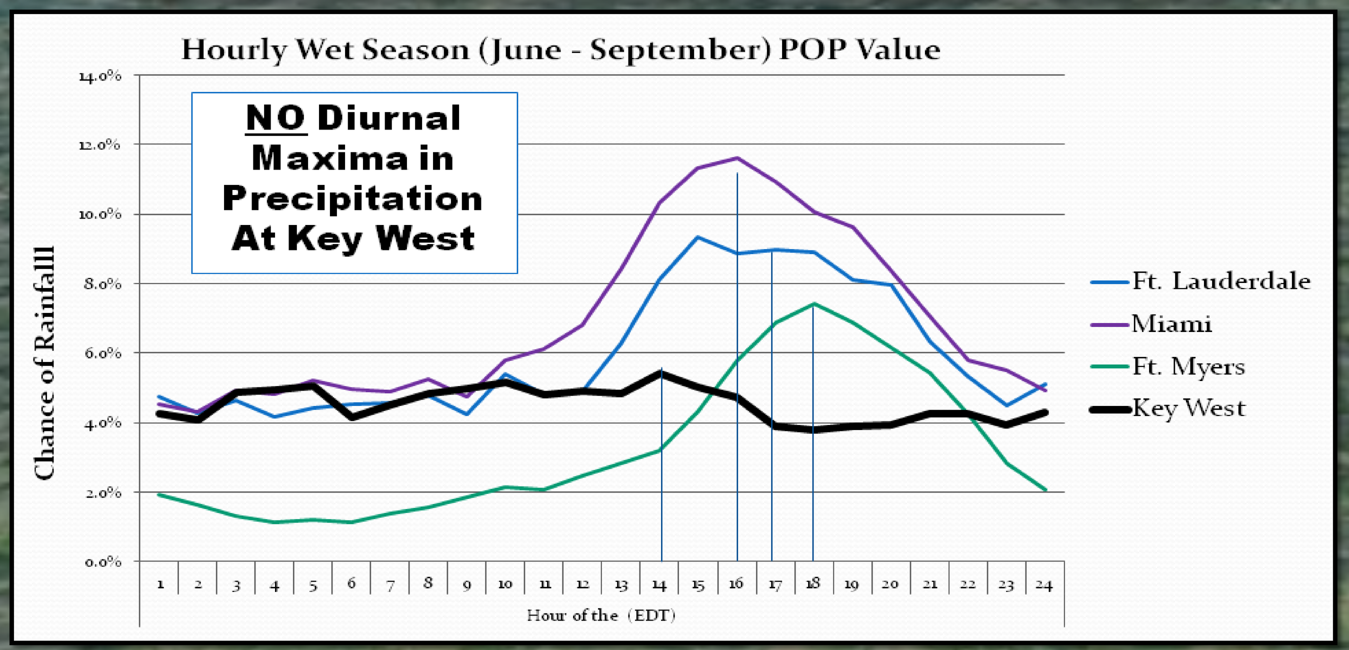
Background and Motivations

- While favorable daily, synoptic-scale patterns for convective rainfall are well known inside of institutional knowledge, climatological timing of the initiation of convection is not well documented.
- The primary forecast challenge on a daily basis is when, and where, the onset of convective precipitation will occur.



- Slight variations in the position of the subtropical ridge have large impacts on daily wind flow, and rainfall patterns.
- Incorrect conceptual models (sea-breeze) exist, concerning tropical island convection in a maritime environment.

Differences Compared to South Florida Mainland

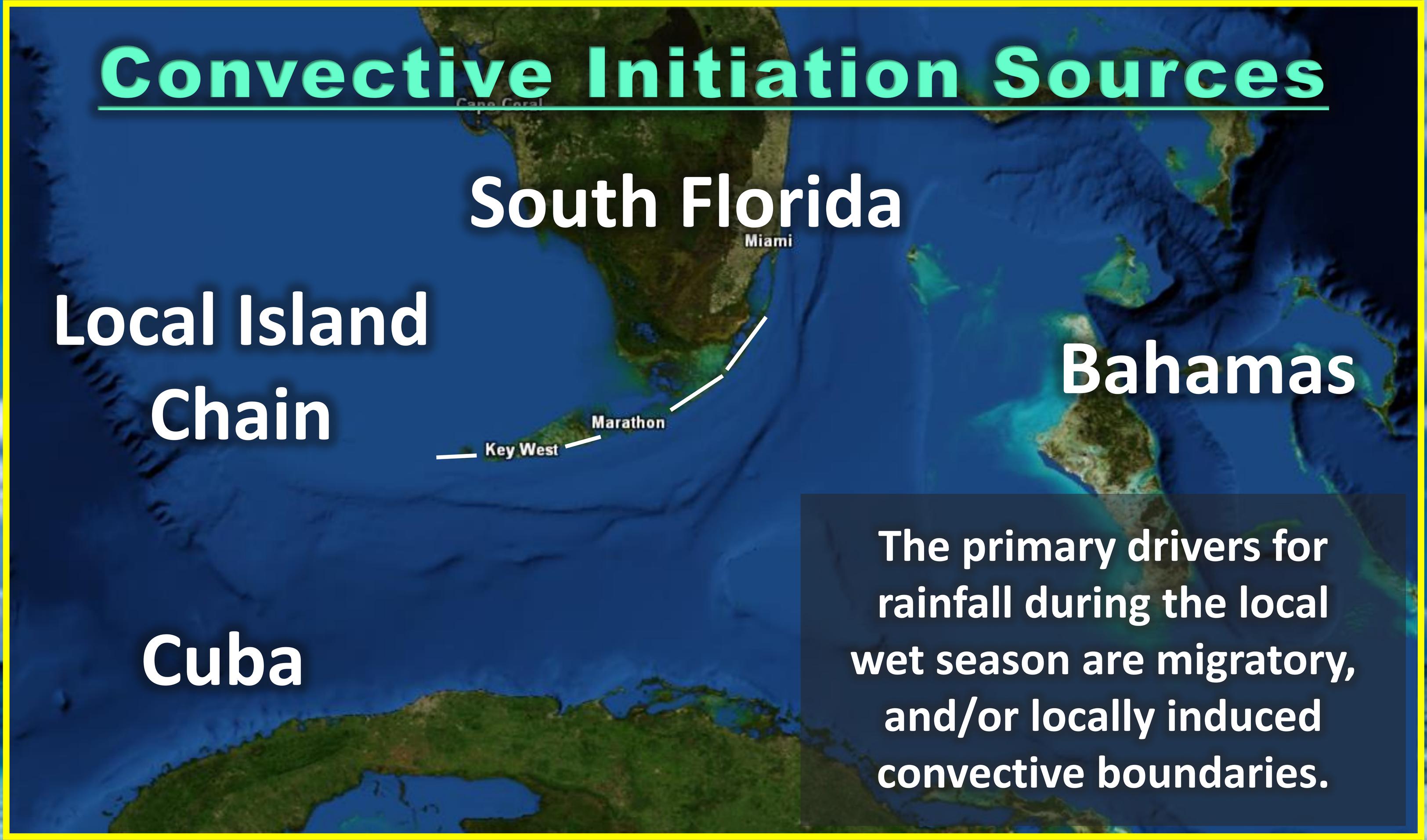


- Mainland rainfall is governed by sea-breeze boundaries.
- Island convection is mainly governed by upwind boundaries.

Study Assumptions

- "Wet Season" defined as June through September
- Always abundant moisture (PWAT ≈ 1.5" – 2.0")
- Tropical cyclones, synoptic events not removed from data
- "Low Level Flow" is vector-averaged 1000-850mb wind
- Stratified by flow direction ONLY (not by magnitude)

Convective Initiation Sources

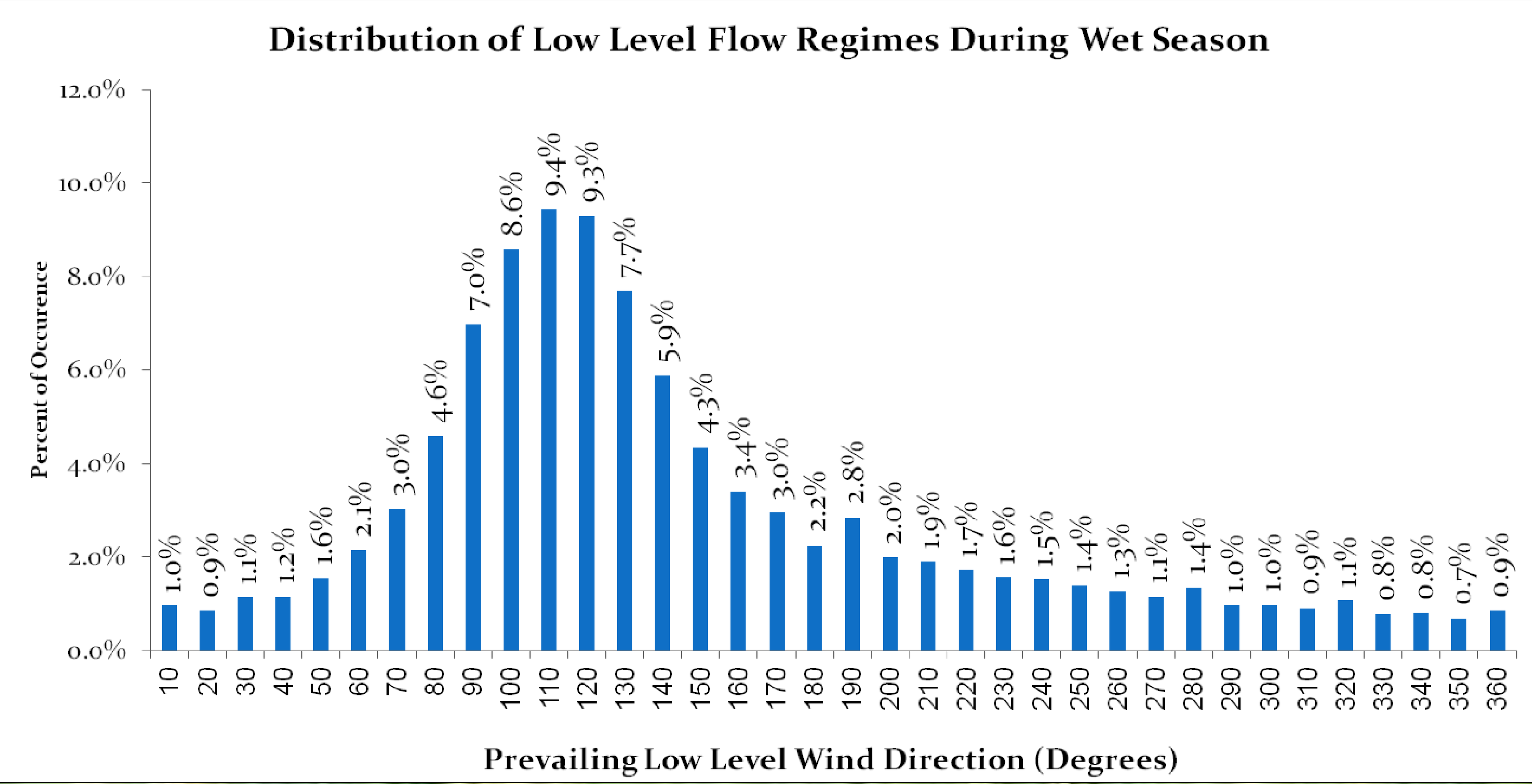


Wet Season Climatology

Month of the year

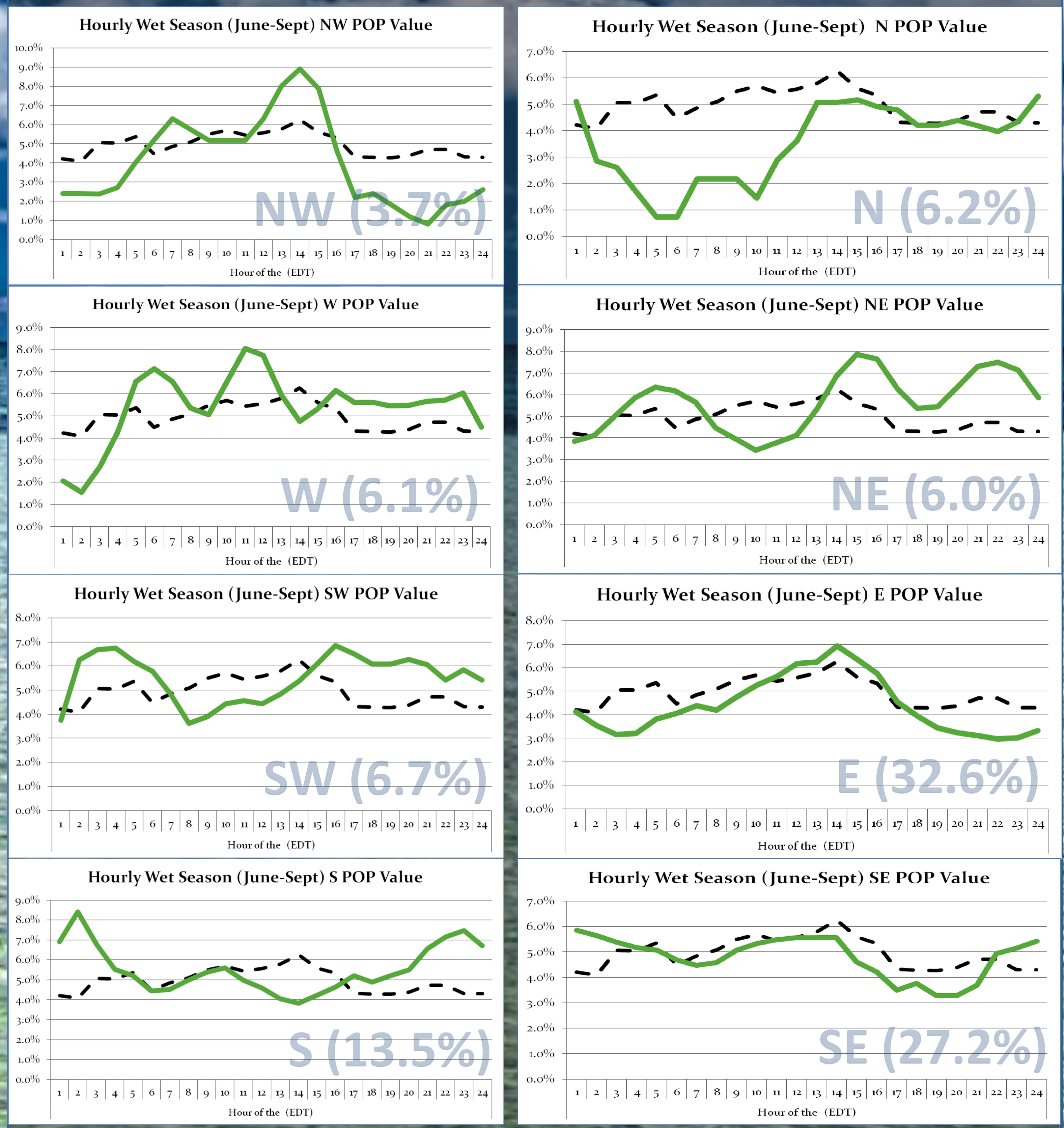
Hour of the Day (EDT)	MAY	JUN	JUL	AUG	SEP	OCT
1	3.4%	3.7%	3.0%	4.6%	5.6%	5.2%
2	3.1%	3.7%	3.0%	3.8%	5.9%	5.0%
3	3.6%	3.3%	3.1%	6.0%	7.8%	5.5%
4	3.4%	4.4%	2.4%	5.1%	8.3%	6.1%
5	3.4%	4.7%	3.8%	5.9%	7.1%	5.5%
6	2.3%	3.8%	2.3%	4.0%	7.9%	4.7%
7	2.4%	4.2%	2.5%	4.8%	7.9%	5.3%
8	2.0%	4.6%	4.3%	4.8%	6.7%	6.6%
9	3.1%	4.1%	4.5%	6.3%	7.0%	4.7%
10	3.1%	5.2%	4.1%	5.5%	8.0%	5.1%
11	2.5%	5.1%	4.3%	6.2%	6.1%	4.6%
12	2.8%	4.6%	5.9%	6.0%	5.8%	4.4%
13	2.5%	4.8%	5.6%	5.5%	7.3%	3.4%
14	2.6%	3.9%	6.2%	6.8%	8.1%	5.0%
15	2.5%	4.4%	5.3%	6.3%	6.3%	5.3%
16	2.3%	3.8%	5.0%	5.4%	7.2%	4.8%
17	1.7%	3.1%	3.9%	4.3%	6.0%	4.4%
18	1.7%	3.4%	3.3%	4.6%	5.8%	3.8%
19	1.8%	3.9%	3.0%	4.4%	5.8%	4.4%
20	2.3%	3.9%	2.0%	5.1%	6.6%	3.9%
21	2.4%	5.2%	2.9%	4.8%	5.9%	4.4%
22	2.6%	5.3%	2.9%	4.2%	6.4%	4.2%
23	2.4%	5.3%	2.0%	4.2%	5.7%	4.1%
24	3.6%	3.6%	2.3%	5.4%	6.0%	5.1%

- A gradual increase in moisture throughout the season results in an increasing trend for daily rainfall chances.
- July shows the maximum diurnal variability, and hence is most similar to a continental Florida shower regime.
- September has the highest rain probabilities, but also the least amount of diurnal variability.



Hourly Rain Chances By Wind Regime

Blue Labels show wind direction and percent of occurrence
Black Lines are Average Climatology by all Regimes.
Green Lines are the hourly values for each wind flow.



- NE: Afternoon max due to local cloud lines with subsequent evening maximum caused by S. Florida outflow boundaries
- E and SE: most common, and most like climatology
- S: Cuban land breeze boundaries evening and overnight; afternoon minimum with divergence, and blocked flow

Research to Operations

- This study, with subsequent collaboration, has improved communication with core aviation partners.
- The timing of convective initiation from climatology has shown utility as a forecast, and planning tool.
- Ongoing research will expand climatology to other possible causal factors; e.g. wind speed, vertical moisture profiles, convective parameters.