

Modeling and Validating the Daily Onset of the Florida East Coast Sea Breeze over the Kennedy Space Center

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Presentation Outline

- **Background on ERDAS RAMS**
- **RAMS Configuration in ERDAS**
- **Subjective Sea-Breeze Evaluation Methodology**
- **Results (1999 & 2000 Florida Warm Seasons)**
- **Summary**

Background on ERDAS

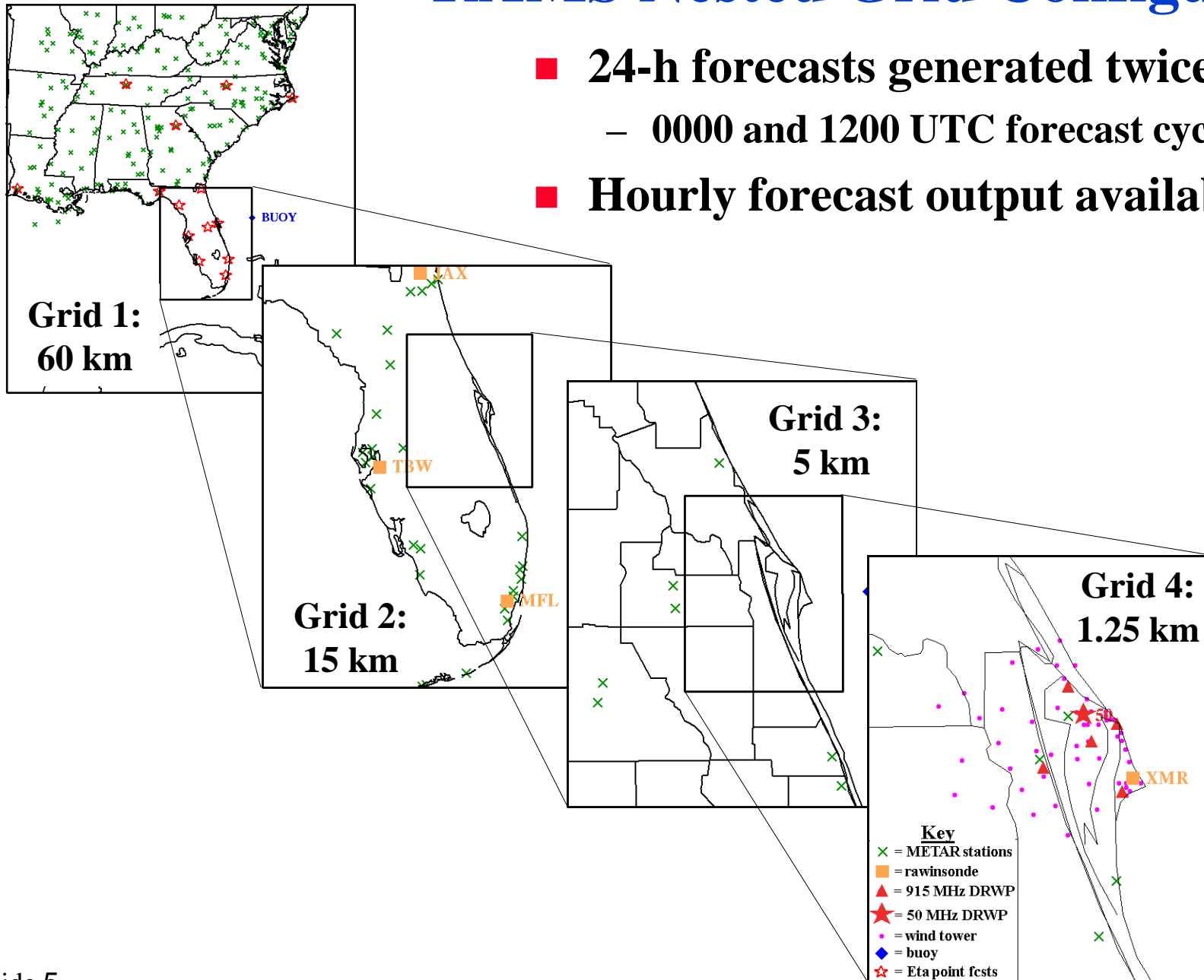
- **ERDAS → Emergency Response Guidance at Cape Canaveral Air Force Station**
 - Used by Range Safety for dispersion modeling
 - Minimize toxic hazards during space operations
- **Regional Atmospheric Modeling System (RAMS)**
- **Customer prioritized task**
 - Systematic evaluation of current RAMS configuration
 - Forecast / verification tools for 45th Weather Squadron

ERDAS RAMS Configuration

- 4 nested grids (2-way interactive on grids 2, 3, 4)
- Full microphysics on grids 1-4
- Kuo-type cumulus parameterization on grids 1-3
- 3D non-hydrostatic
- Mellor-Yamada TKE
- Chen and Cotton radiative parameterization
- Vegetation temperature / moisture model (11 soil layers - fixed initial soil moisture)
- Lateral BC: nudged by 12-36 h Eta forecasts

RAMS Nested Grid Configuration

- 24-h forecasts generated twice daily
 - 0000 and 1200 UTC forecast cycles
- Hourly forecast output available

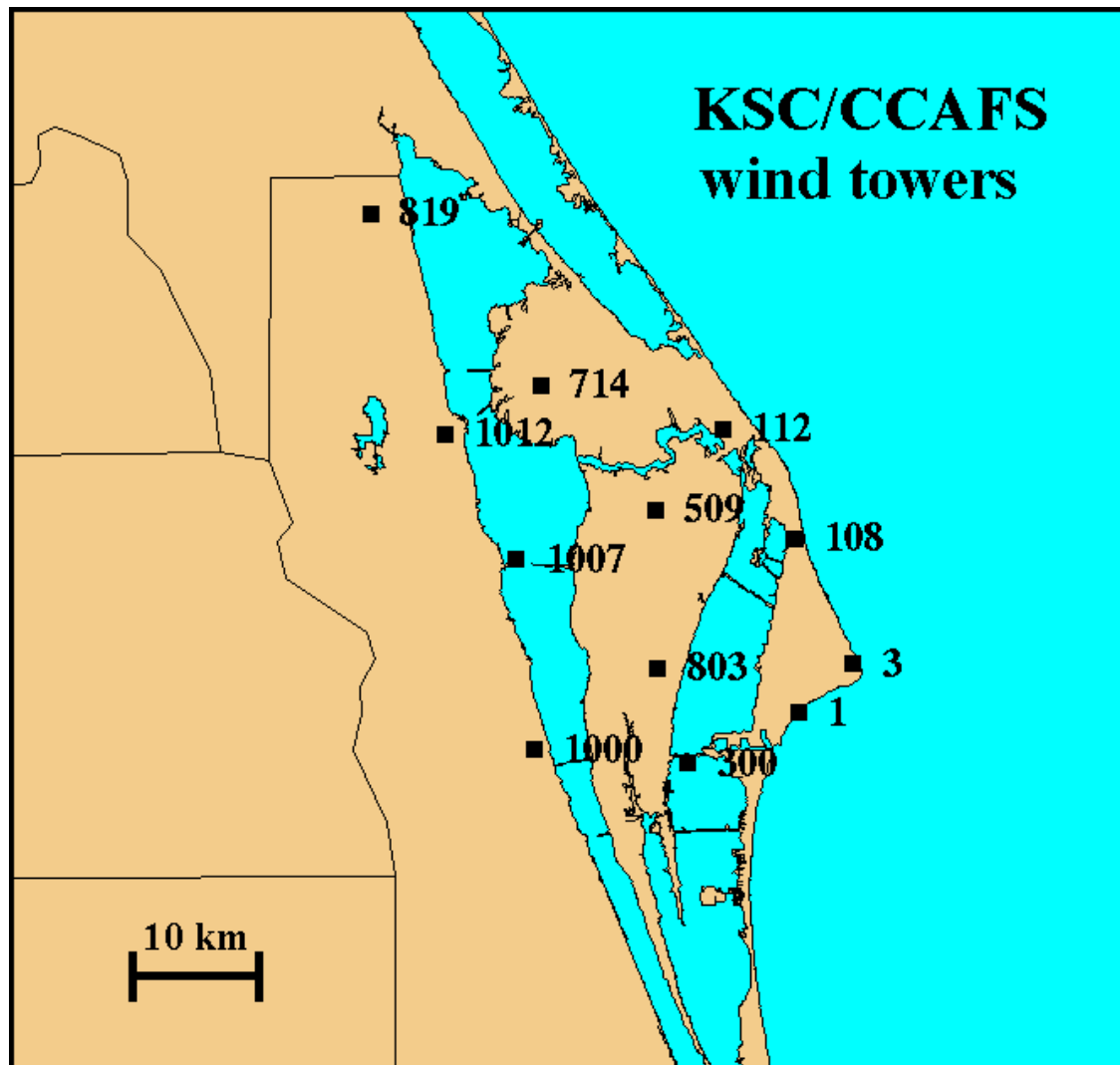


Grid	nx	ny	nz	dx (km)	dt (s)
1	36	40	33	60	45
2	38	46	33	15	45
3	41	50	36	5	22.5
4	74	90	36	1.25	7.5

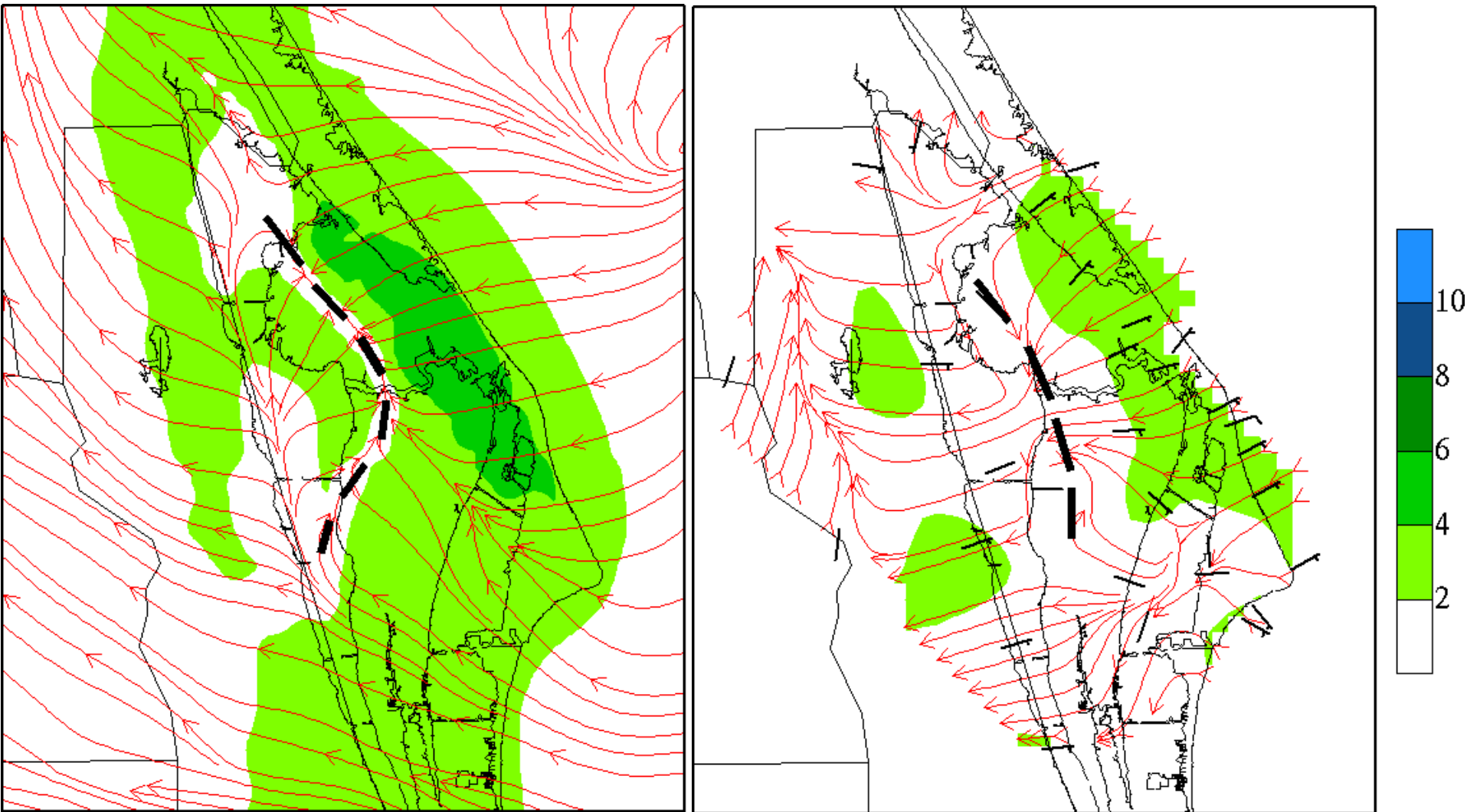
Subjective Evaluation Methodology

- **1999 and 2000 Warm Seasons**
 - **East Coast Sea Breeze (ECSB)**
 - » **May–Aug 1999 ; May–Sep 2000**
 - » **Occurrence (Radar & visible satellite data)**
 - » **Verify ECSB forecasts at 12 selected wind towers**
 - » **4-grid vs. 3-grid comparison (2000 only)**
 - » **RAMS vs. Eta at TTS**
 - » **Develop contingency tables of occurrence**
 - » **Compute timing error statistics (RMS error, bias)**

12 Local Wind Towers used in Sea Breeze Verification



Sea-breeze Example: 18 Aug. 2000



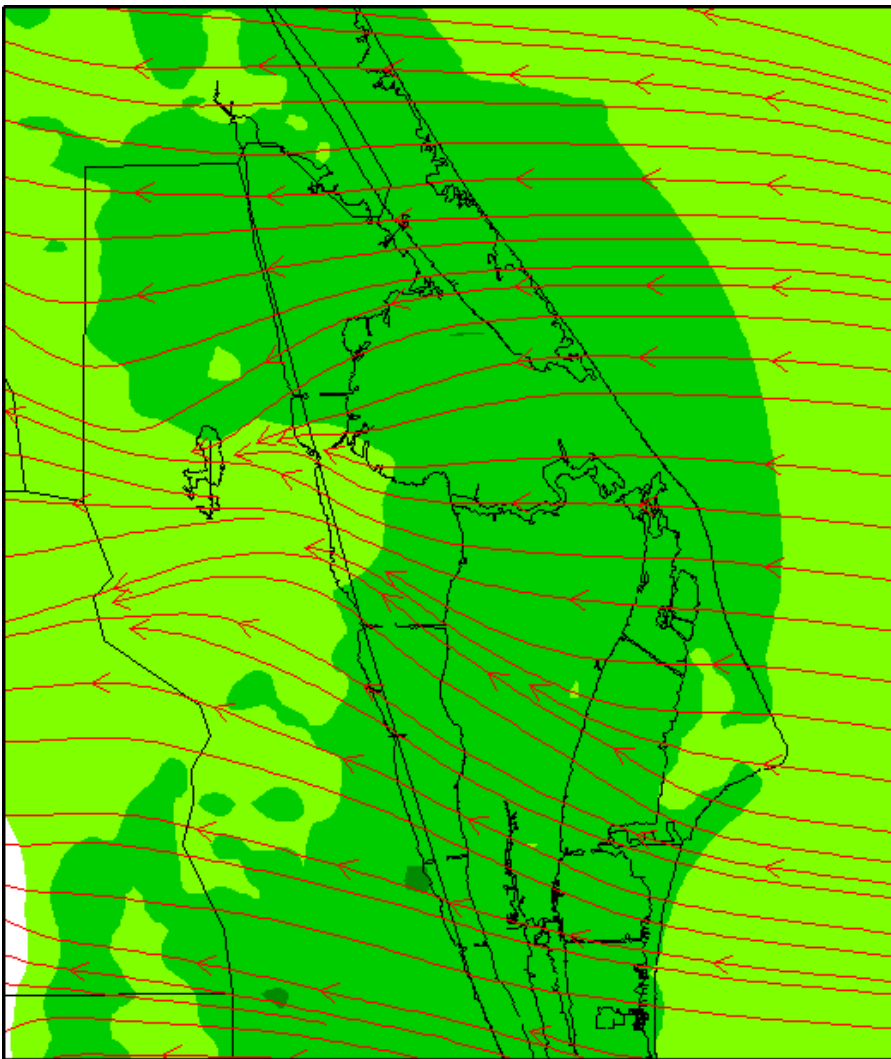
0000 UTC cycle, 16-h fest

18 Aug 2000 1600 UTC

FCST

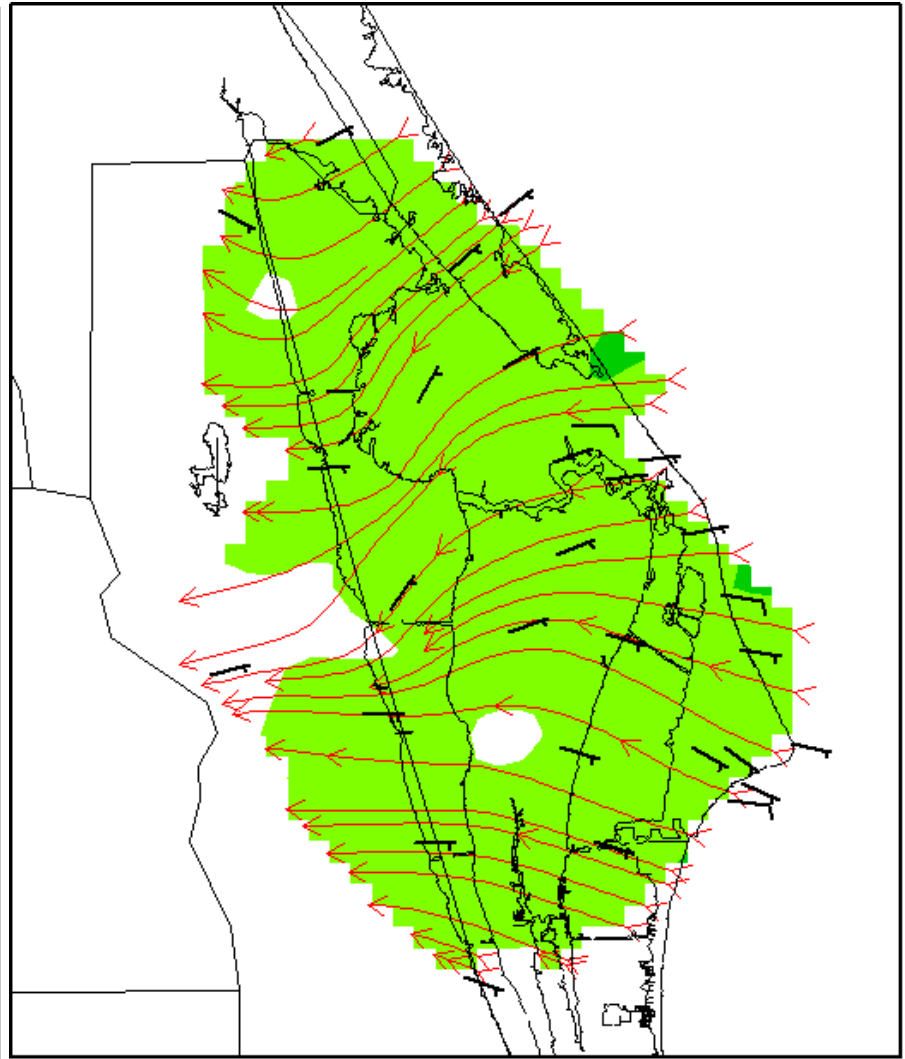
OBS

Sea-breeze Example: 18 Aug. 2000



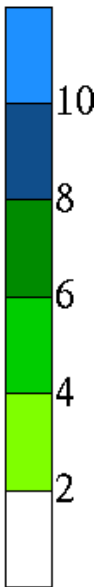
0000 UTC cycle, 18-h fest

FCST



18 Aug 2000 1800 UTC

OBS



Sea Breeze Results: Occurrence & Timing

(May–Aug 99 / May–Sep 00; 0000 / 1200 UTC)

RAMS Sea-Breeze Occurrence		
Score	0000 Z	1200 Z
POD	0.86	0.98
FAR	0.16	0.16
Bias	1.02	1.16
CSI	0.74	0.83
HSS	0.56	0.69

Timing Errors (hours)			
Location	Statistic	0000 Z Cycle	1200 Z Cycle
Coastal Towers	RMS Error	1.8	1.5
	Bias	-0.3	-0.3
Merritt Island Towers	RMS Error	1.9	1.7
	Bias	-0.3	-0.2
Mainland Towers	RMS Error	2.1	1.9
	Bias	-0.3	-0.2

Sea Breeze Results: Sensitivity studies

(May–Sep 2000; 0000 / 1200 UTC)

RAMS 4-grid vs. 3-grid				
Score	0000 Z Cycle		1200 Z Cycle	
	RAMS 4-grid	RAMS 3-grid	RAMS 4-grid	RAMS 3-grid
POD	0.82	0.71	0.98	0.92
FAR	0.17	0.19	0.15	0.15
Bias	0.98	0.88	1.15	1.08
CSI	0.70	0.61	0.84	0.79
HSS	0.54	0.41	0.71	0.64

RAMS vs. Eta at TTS				
Score	0000 Z Cycle		1200 Z Cycle	
	RAMS	Eta	RAMS	Eta
POD	0.83	0.53	0.92	0.77
FAR	0.15	0.13	0.18	0.09
Bias	0.98	0.61	1.12	0.85
CSI	0.72	0.49	0.77	0.71
HSS	0.61	0.38	0.68	0.65

Summary

- **RAMS: High skill in sea-breeze forecasts**
 - 98% POD in 1200 UTC forecast
 - 1.25-km grid better than 5-km grid
 - Greater skill than Eta in 0000 UTC forecasts

- **AMU Quarterly reports:**

<http://technology.ksc.nasa.gov/WWWaccess/AMU>