

Evaluation of RAMS in the Eastern Range Dispersion Assessment System

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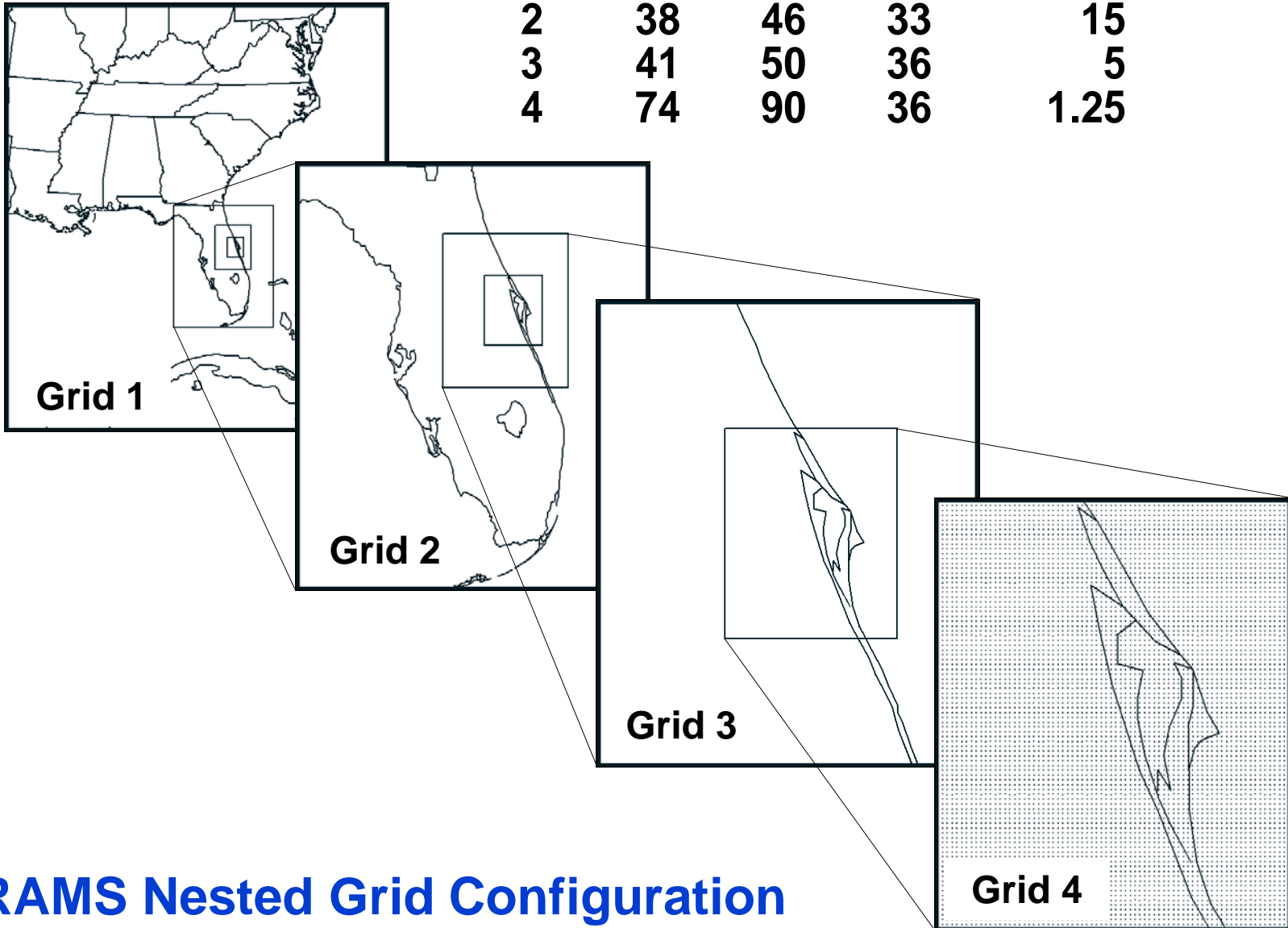
Presentation Outline

- **ERDAS RAMS Configuration**
- **Model Evaluation**
 - **Objective and Subjective Components**
- **Objective Results**
- **Subjective Results**
- **Summary**

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

Grid	NX	NY	NZ	ΔX (km)	ΔT (s)
1	36	40	33	60	90
2	38	46	33	15	45
3	41	50	36	5	22.5
4	74	90	36	1.25	7.5



RAMS Nested Grid Configuration

RAMS Initialization and Forecast

- **Data obtained at 0000 and 1200 UTC**
 - 12-h forecast from Eta
 - Rawinsondes
 - Surface stations & buoys
 - Local wind towers
 - 5 local 915 MHz & 1 local 50 MHz profilers
- **Isentropic analysis using Barnes**
- **Cold start (no 4DDA or cycling with RAMS forecasts)**
- **24-h RAMS forecasts generated**
- **Hourly forecast output available**

RAMS Evaluation

■ Objective component

- **Point verification** (automated real-time archive)
 - » **Bias, RMS** in **T**, **T_d**, **u**, **v**, **Wind direction & Speed**
 - » **13 selected local wind towers on grid 4**
 - » **Land, buoy, tower, profiler, & raob sites on grids 1-4**
 - » **Eta benchmark**
- **Grid verification (difference fields on grid 4)**
- **Limited sensitivity / case studies**
 - » **Soil moisture**
 - » **Horizontal resolution**
 - » **Parameterization schemes**
- **May through August 1999**

RAMS Evaluation (cont.)

- **Subjective Component (real-time evaluation)**
 - **Central Florida east coast sea breeze (grid 4 only)**
 - » **Identify occurrence (WSR-88D & 1-km visible satellite data)**
 - » **Onset & propagation (13 local towers)**
 - » **Compare with model forecasts at 13 towers**
 - **Precipitation on grid 4**
 - **Low-level Temperature inversions**
 - **May through August 1999**

**Kennedy Space
Center**

**Cape Canaveral
Air Station**

■ 1617

■ 714

■ 398

■ 1012

■ 509

■ 2008

■ 108

■ 1204

■ 3

■ 1500

■ 1000

■ 300

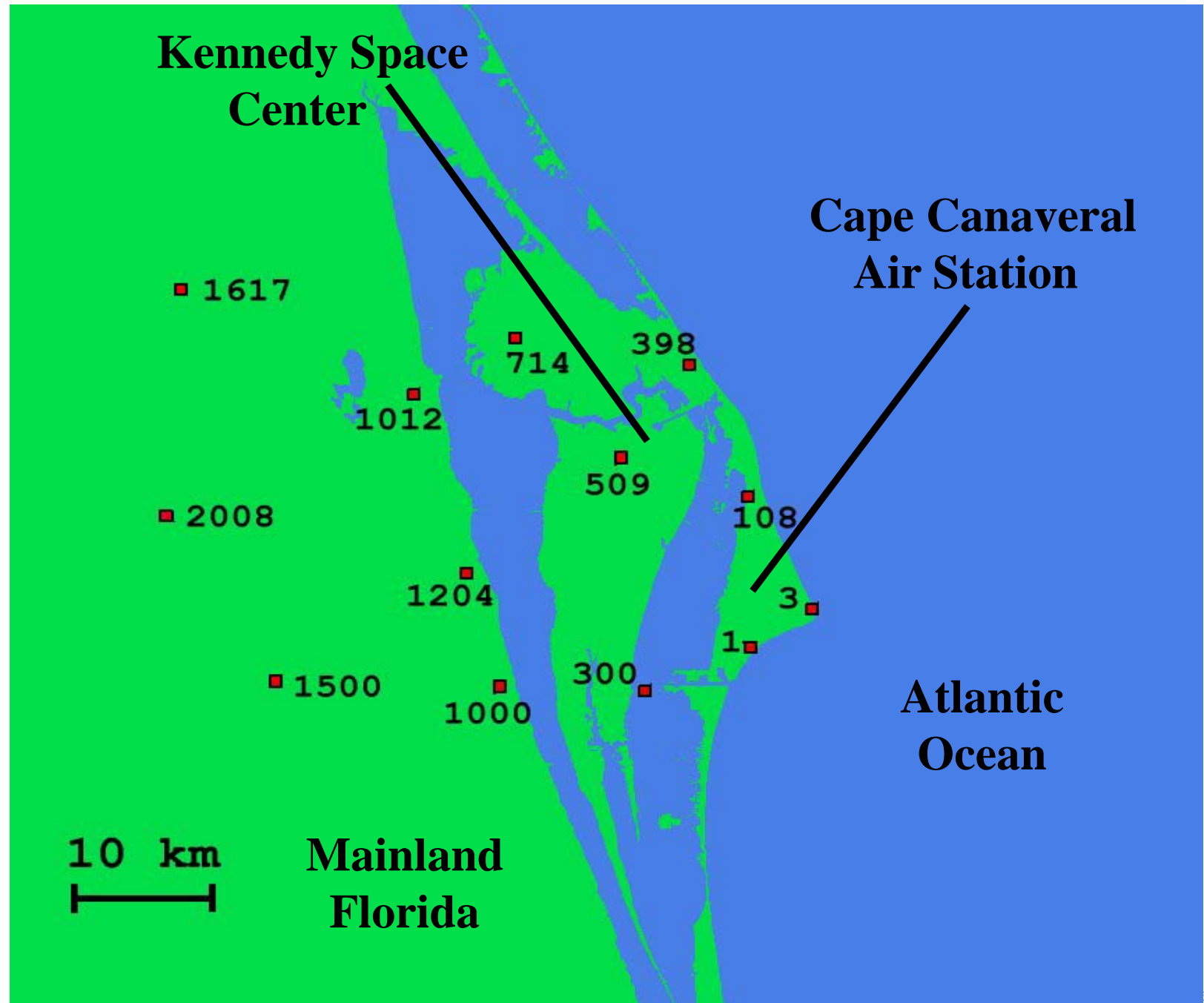
■ 1

**Atlantic
Ocean**

10 km

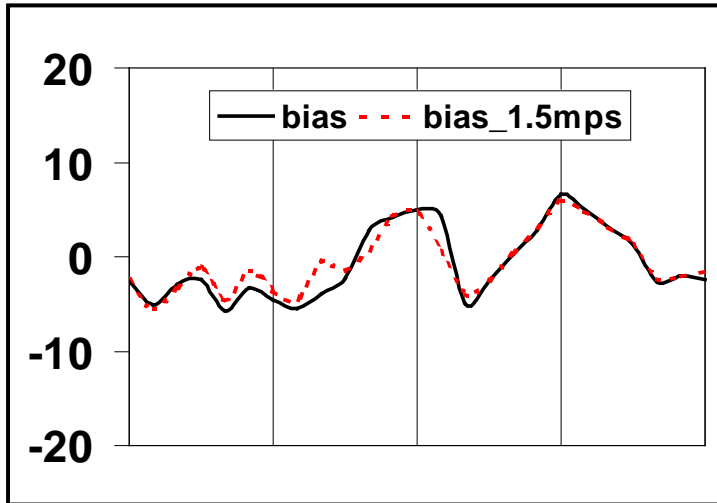


**Mainland
Florida**



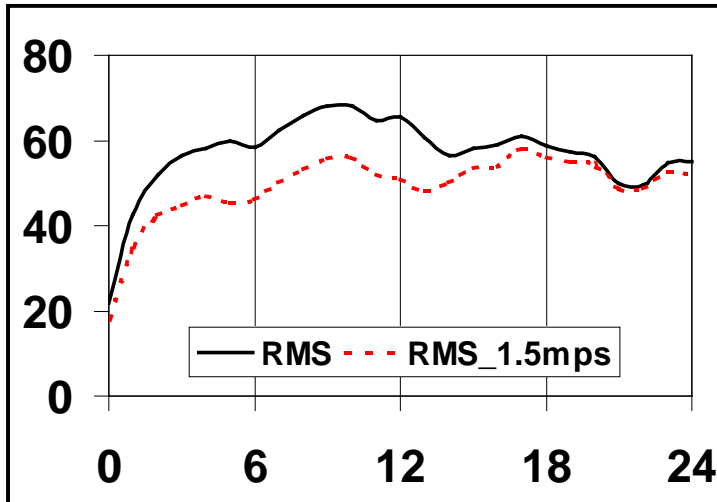
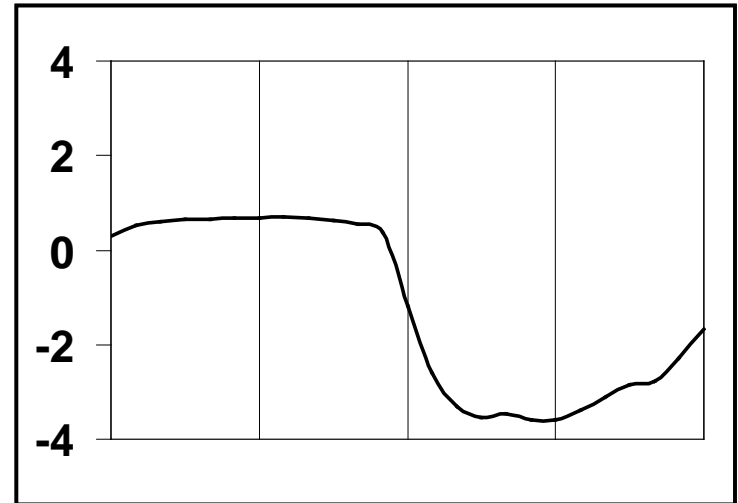
Objective Verif. (May–Aug, 0000 UTC only)

Wind Direction (°)

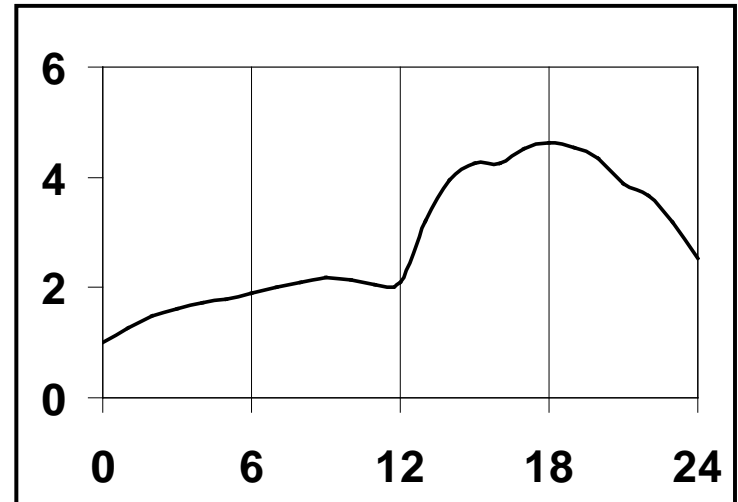


Bias
(systematic error)

Temperature (°C)



RMS Error
(total error)



Forecast Hour

Forecast Hour

Subjective Verif. (May–Aug, 0000 & 1200 UTC)

TABLE 1. Contingency table of sea breeze occurrence.

	Observed Sea Breeze	No Observed Sea Breeze
Forecast Sea Breeze	110	3
Sea Breeze Not Forecast	6	16

Probability of Detection: 0.95

False Alarm Ratio: 0.03

Critical Success Index: 0.92

Heidke Skill Score: 0.74

TABLE 2. Sea-breeze timing error statistics for May–August 1999.

	0000 UTC	1200 UTC	All
MAE (h)	0.9	0.9	0.9
RMS (h)	1.3	1.3	1.3
SD (h)	1.3	1.3	1.3
Bias (h)	-0.2	0.1	0.0

Summary

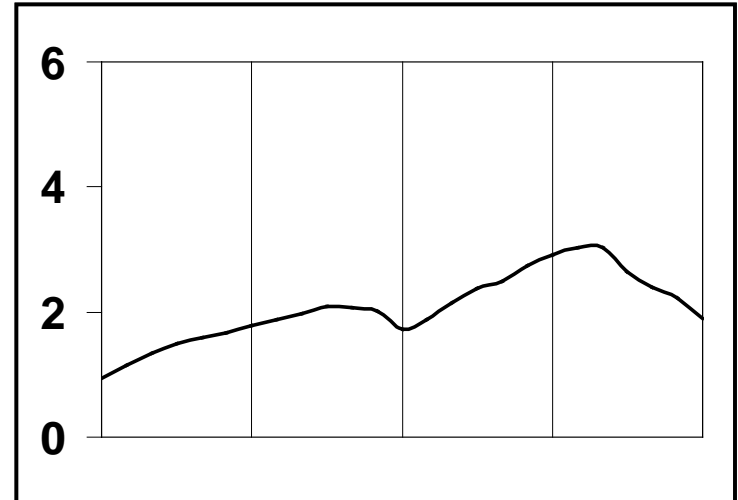
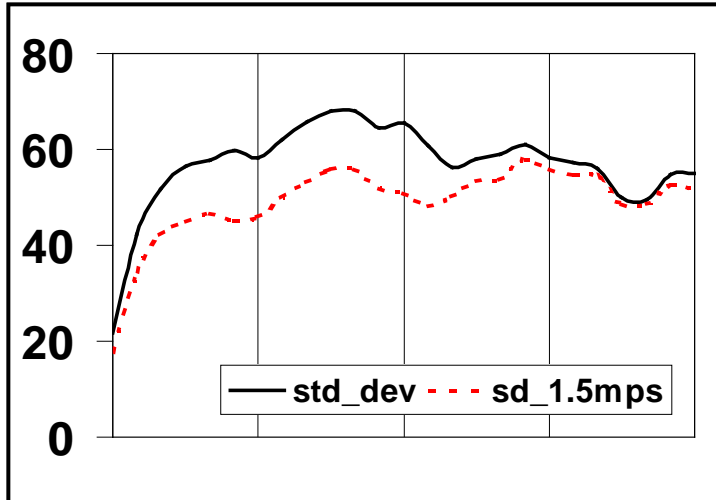
- **Wind Dir: Unbiased, 50-70° non-systematic error**
 - Largest during nighttime hours (light wind regimes)
 - 15-23° composed of observational variability (Merceret 1995)
 - 35-50° remaining model error → cannot resolve obs features
- **Temperature: Cool daytime bias (up to 4 °C)**
- **RAMS: Excellent in forecasting onset and movement of central FL ECSB**
 - Occurrence
 - Timing at each wind tower (within 1 h)
- **AMU Quarterly reports:**
<http://technology.ksc.nasa.gov/WWWaccess/AMU>

St. Dev. vs. RMS (May-Aug, 0000 UTC)

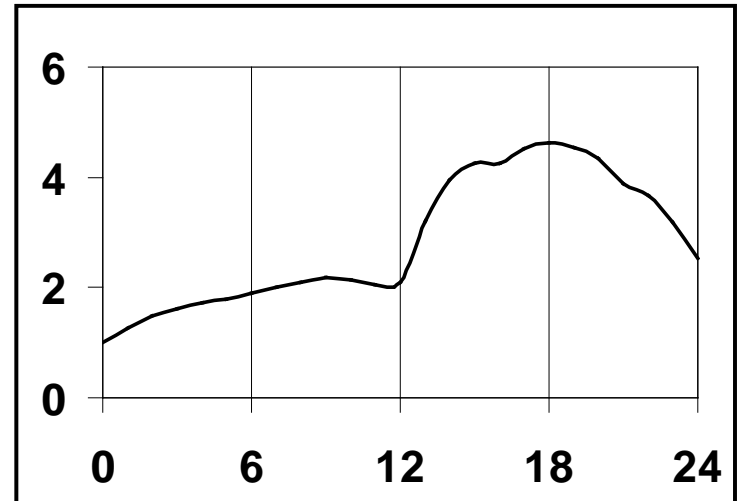
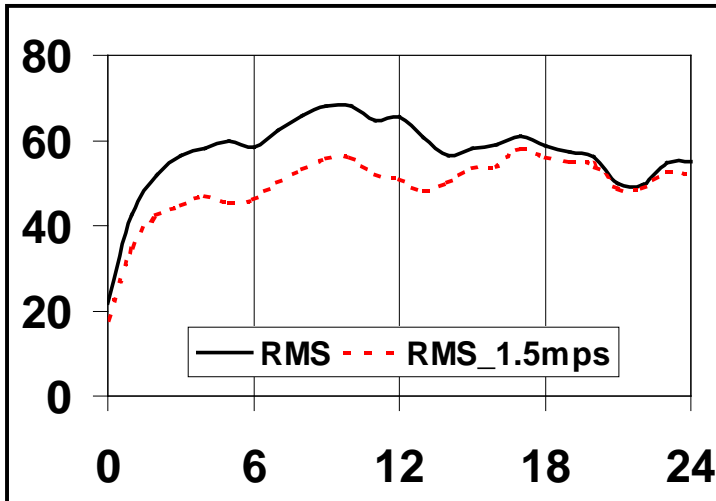
Wind Direction (°)

Temperature (°C)

**St.
Dev.
(non-sys.
error)**



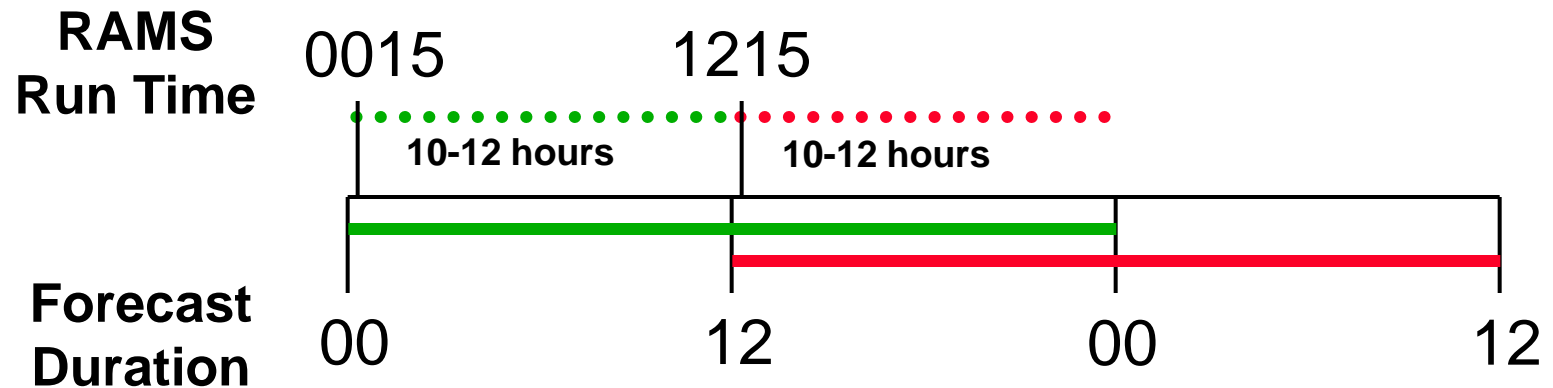
**RMS
Error
(total error)**



Forecast Hour

Forecast Hour

RAMS Operational Cycle



- RAMS run on (3) HP-K460 (11 processors total)
- Prognostic data still available for 1-cycle failure