AN OBJECTIVE EVALUATION AND REGIME CLASSIFICATION OF RAMS FORECAST ERRORS DURING THE 2000 FLORIDA WARM SEASON

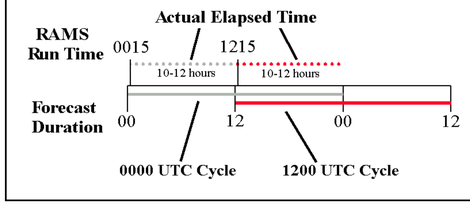
Jonathan L. Case*, John Manobianco, and Allan V. Dianic (NASA Kennedy Space Center / Applied Meteorology Unit / ENSCO, Inc.)
Dewey E. Harms (45th Weather Squadron, United States Air Force, Patrick AFB, FL)
Paul N. Rosati (45th Space Wing, Eastern Range Safety, United States Air Force, Patrick AFB, FL)

RAMS FORECASTS IN ERDAS

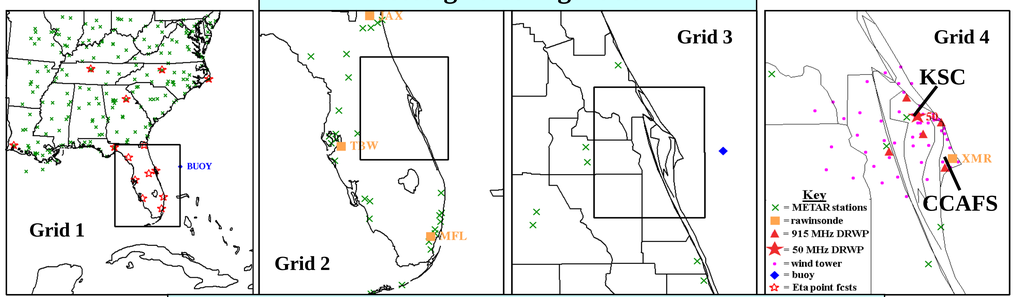
RAMS Grid Parameters

Grid	nx	ny	nz	dx (km)	dz (m)
1	36	40	33	60	50
2	38	46	33	15	50
3	41	50	36	5	25
4	74	90	36	1.25	25

RAMS Daily Forecast Cycle



Nested grid configuration



Locations of point verification stations shown in each grid.

- **Eastern Range Dispersion Assessment System (ERDAS).**
- **Dispersion predictions → Emergency response guidance at the Kennedy Space Center (KSC) and the Cape Canaveral Air Force Station (CCAFS) during space launch operations.**
- **RAMS forecasts → Input to ERDAS dispersion models.**
- **Accuracy of dispersion models dependent on RAMS accuracy.**
- **Run at very fine grid spacing to capture evolution of sea breeze.**

EVALUATION METHODOLOGY

of Days with offshore, onshore, and Light sfc wind regimes (May–Sep 2000)

RAMS cycle	Onshore (easterly)	Offshore (westerly)	Light (< 5 kt)
0000 UTC	41	44	32
1200 UTC	46	49	35

Observed vs. Forecast T-storm days (May–Sep 2000, 1200 UTC forecast)

	Observed T-storms	T-storms not Observed
Forecast T-storms	72	25
T-storms not forecast	11	38

- **Surface wind regime according to KSC/CCAFS wind-tower observations.**
- **Observed t-storm days according to data from a local lightning surveillance system during 1500–2300 UTC on grid 4 only.**
- **Forecast t-storm days determined by minimum RAMS vertical velocity at 7 km and sfc. rain rates ≥ 5 mm h^{-1} on grid 4. (Refer to Case *et al.* companion poster.)**

- **Verify RAMS errors at KSC/CCAFS wind-towers for:**
  - Each surface wind regime.
  - Each t-storm contingency table element.
  - Compute error statistics:

$$\text{RMS error} = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(\Phi')^2}$$

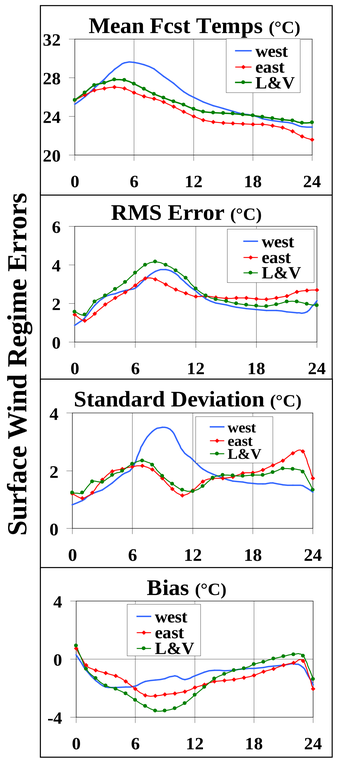
$$\text{Bias} = \frac{1}{N}\sum_{i=1}^{N}\Phi'$$

$$\text{SD} = \sqrt{\text{RMS}^2 - \text{Bias}^2}$$

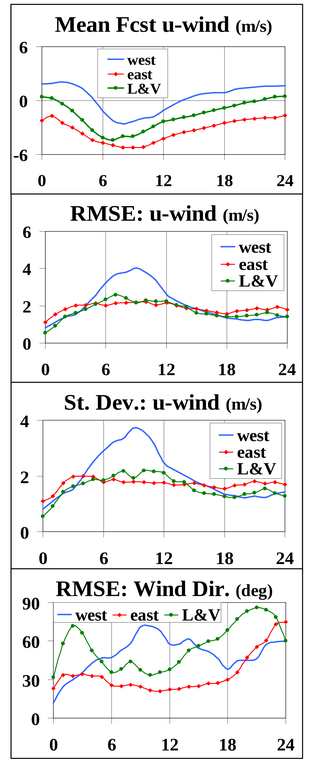
where:
- Φ' is the forecast minus the observed value, and
- N is the sample size.

RESULTS: 1200 UTC FORECAST

Temperatures

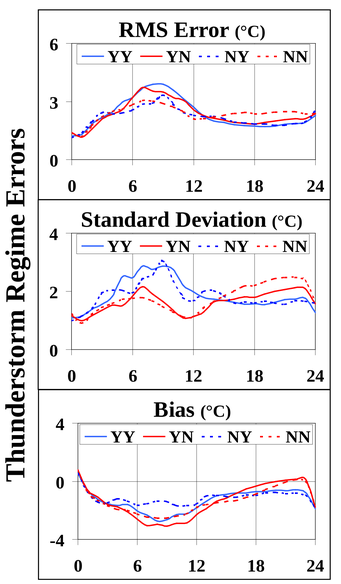


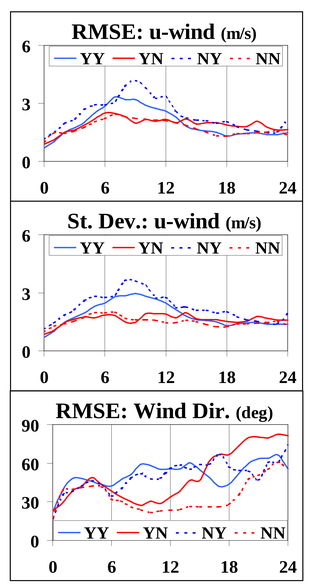
Winds



Surface Wind Regime

- **Largest random T errors under westerly surface flow.**
- **Greatest cold bias under light and variable wind regime.**
- **Westerly flow yields largest random u-wind errors.**
  - Errors in sea-breeze position.
  - Frequent convection / outflow boundaries with west winds.
- **Largest wind direction errors during nocturnal and early morning hours under light and variable wind regimes.**
- **Maximum daytime wind direction RMS errors under westerly flow.**





Thunderstorm Regime
(daytime errors)

- **Convention of contingencies:**
  - YY = Forecast + Obs
  - YN = Forecast + No Obs.
  - NY = No Forecast + Obs.
  - NN = No Forecast + No Obs.
- **Largest RMS errors when RAMS forecasts t-storms.**
- **Largest random T errors on days with observed t-storms.**
- **Observed t-storm days yield the largest u-wind errors and wind-direction RMS errors.**