

A Sensitivity and Benchmark Study of RAMS in the Eastern Range Dispersion Assessment System

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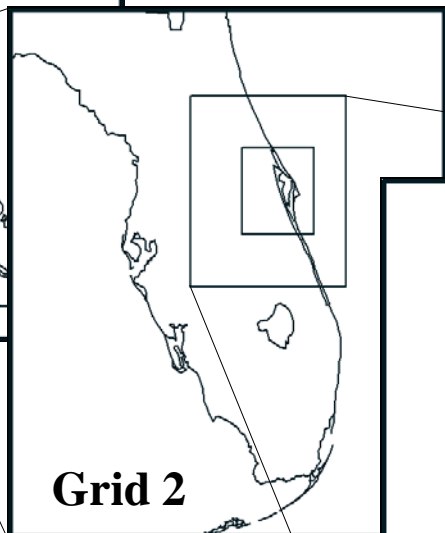
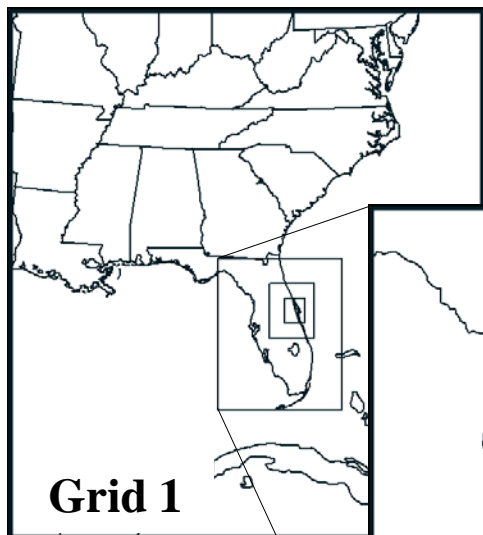
Presentation Outline

- **Background on ERDAS**
- **Configuration**
- **Methodology**
- **Results (May – August 1999)**
 - **Sensitivity experiment (horizontal resolution)**
 - **Benchmark (Comparison to Eta model)**
- **Future Work**
- **Summary**

Background on ERDAS

- **Emergency Response Guidance for Space Launches**
 - Cape Canaveral Air Force Station
 - Kennedy Space Center
- **Regional Atmospheric Modeling System (RAMS)**
- **New version of ERDAS RAMS**
 - AMU recommendations → implemented
 - RAMS model upgrade
 - Finer inner-grid resolution, Full Cloud Microphysics
- **Systematic evaluation of current RAMS needed to validate new configuration of ERDAS**
- **Forecast/Verification tools for 45th Weather Squadron**

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



**Kennedy Space
Center**

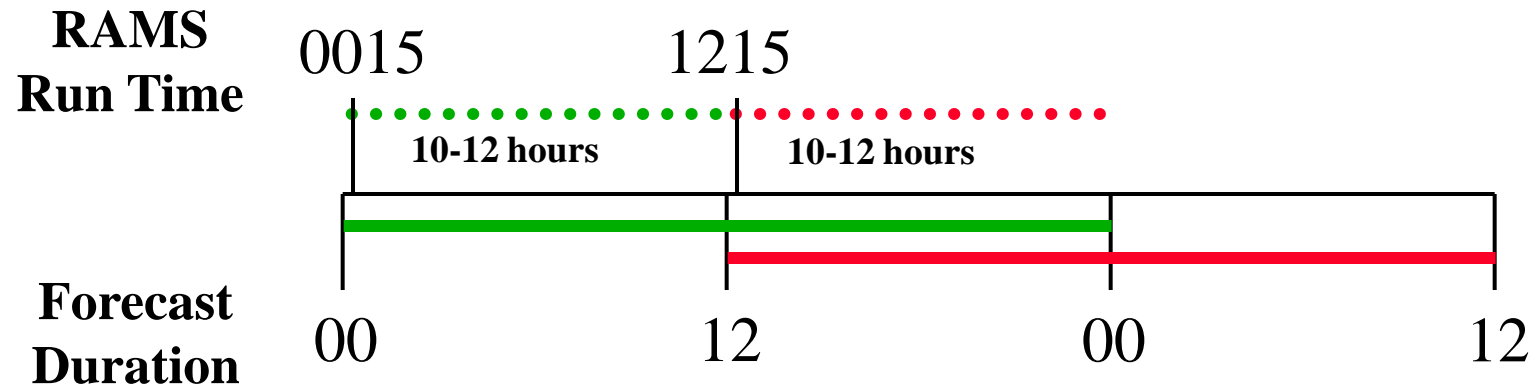
RAMS Nested Grid Configuration in ERDAS

RAMS Initialization and Forecast

- **Data obtained at 0000 and 1200 UTC**
 - 12-h forecast from NCEP Eta model
 - Rawinsondes, surface stations & buoys
 - Local wind towers
 - 5 local 915-MHz & 1 local 50-MHz DRWP

- **Isentropic analysis using Barnes scheme**
- **Cold start (no data assimilation scheme)**
- **24-h RAMS forecasts generated**
- **Hourly forecast output available**

RAMS Operational Cycle

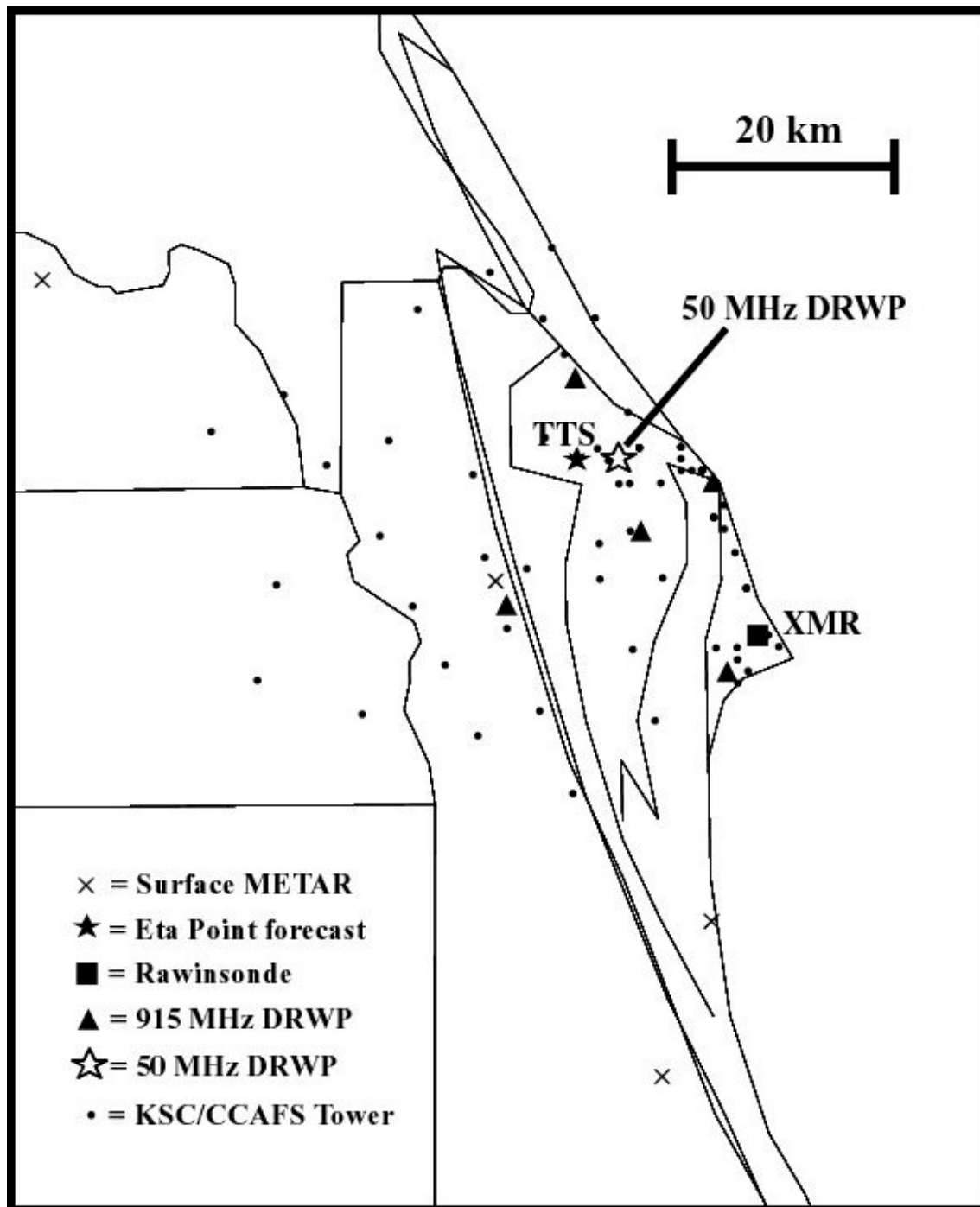


- Eta 12 to 36-h forecasts as boundary conditions
- Prognostic data still available for 1-cycle failure

RAMS Evaluation Methodology

- **Objective component (May – August 1999)**
 - **Point verification of 4-grid RAMS configuration**
 - » **Bias, RMS Error, Standard Deviation of error**
 - » **T, T_d, Wind direction & Speed**
 - » **All available observational data on grid 4**
 - » **Surface land, buoy, & rawinsonde sites on grids 1-3**
 - **Horizontal resolution experiment**
 - » **Run RAMS with 3-grid configuration (grids 1-3 only)**
 - » **Compare errors to 4-grid configuration**
 - **Eta model benchmark**
 - » **Compare RAMS to national-scale Eta model**

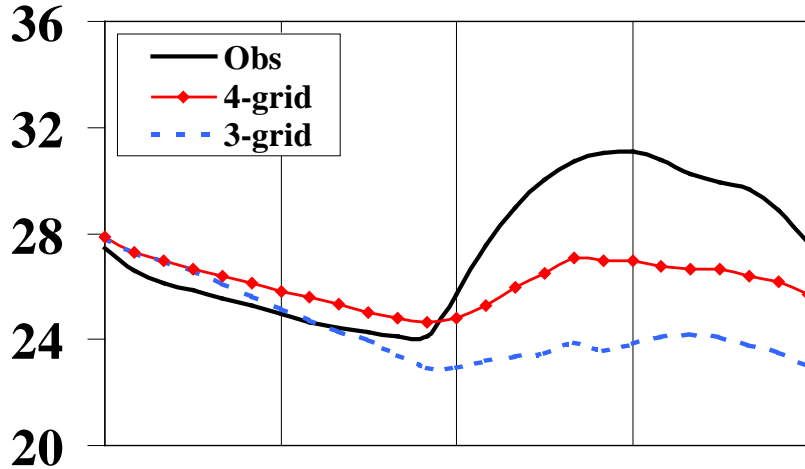
Grid 4 Verification Stations



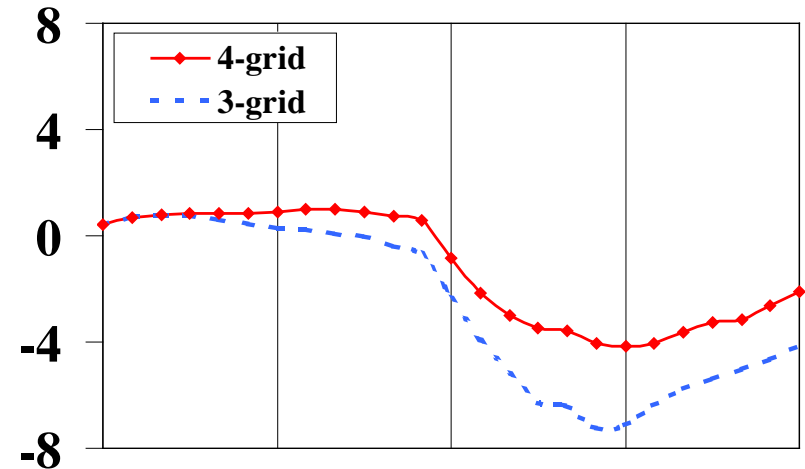
Objective Results: 0000 UTC 4/3-grid Cycle

Temperature ($^{\circ}\text{C}$, wind towers at 1.8 m)

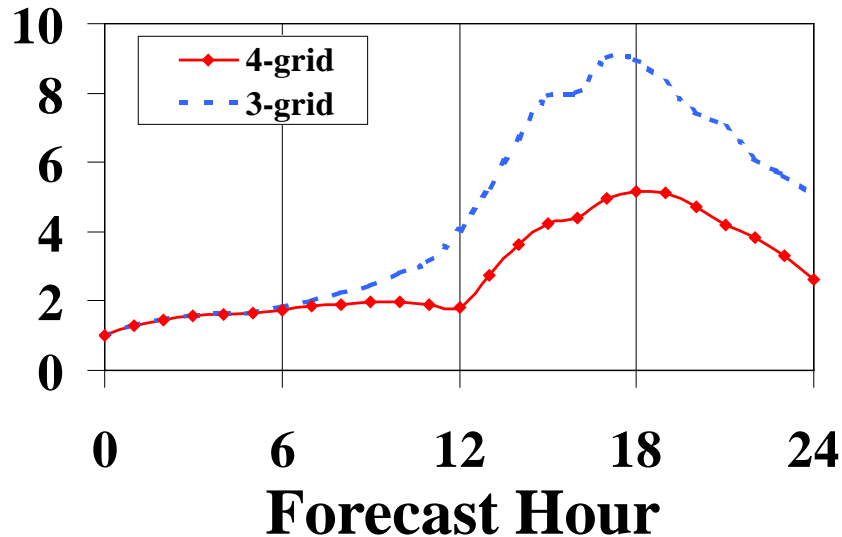
Mean Obs vs. Forecast



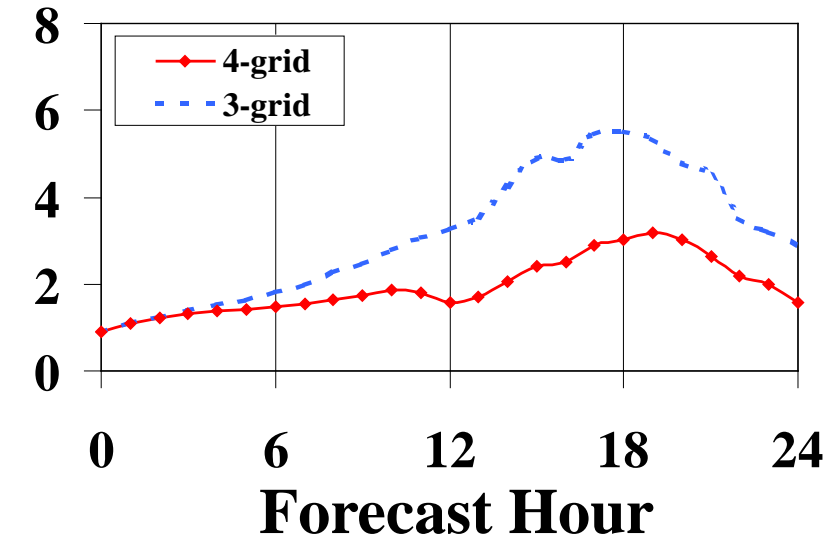
Bias



RMS Error

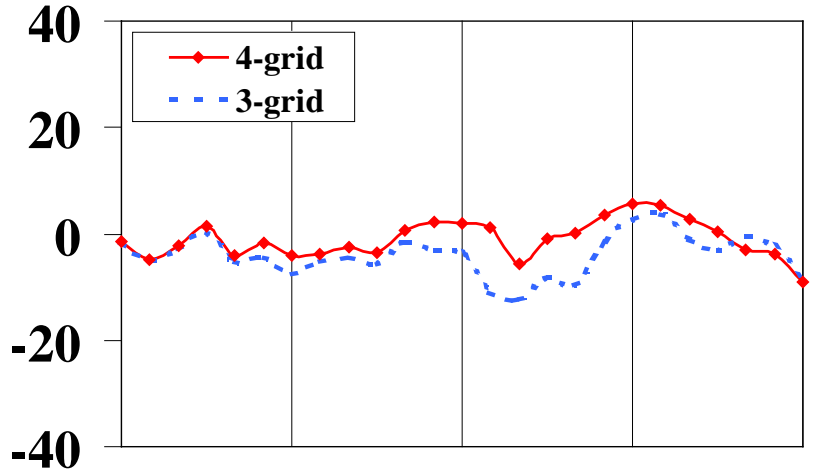


Standard Deviation

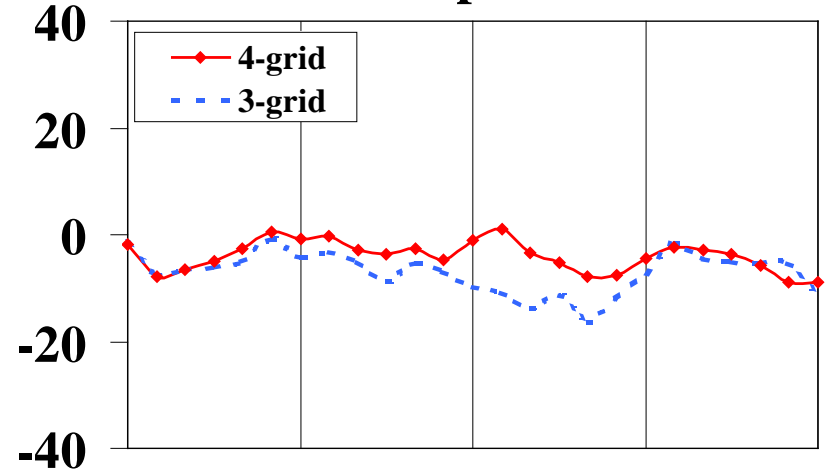


0000 UTC 4/3-grid Cycle: Wind Dir (deg) (wind towers at 16.5 m)

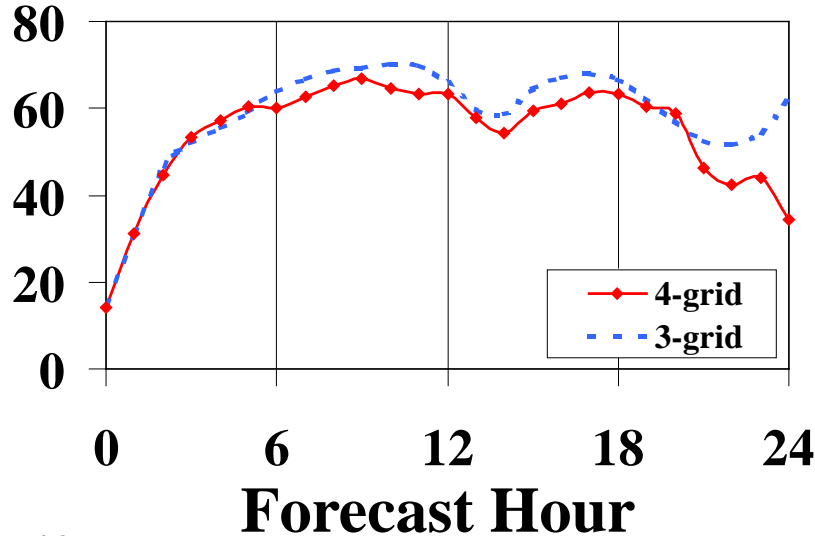
Bias: All Forecasts



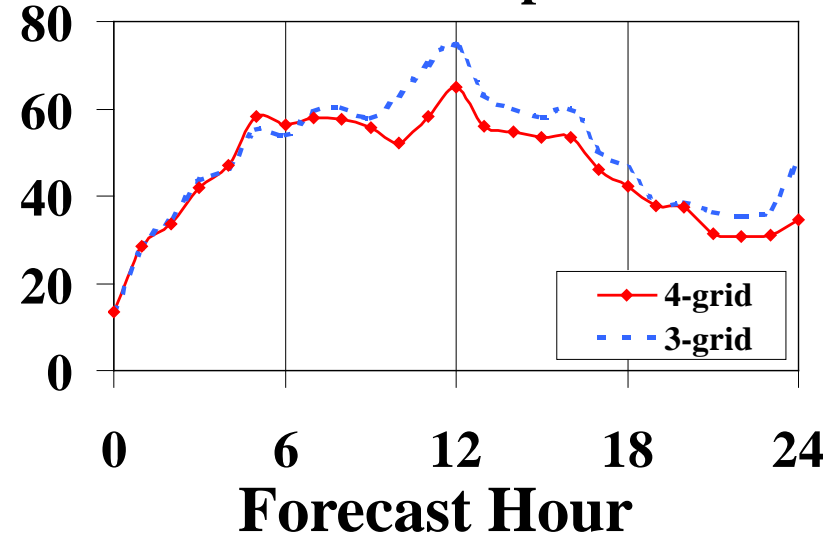
Bias: Completed Runs



RMS Error: All Forecasts

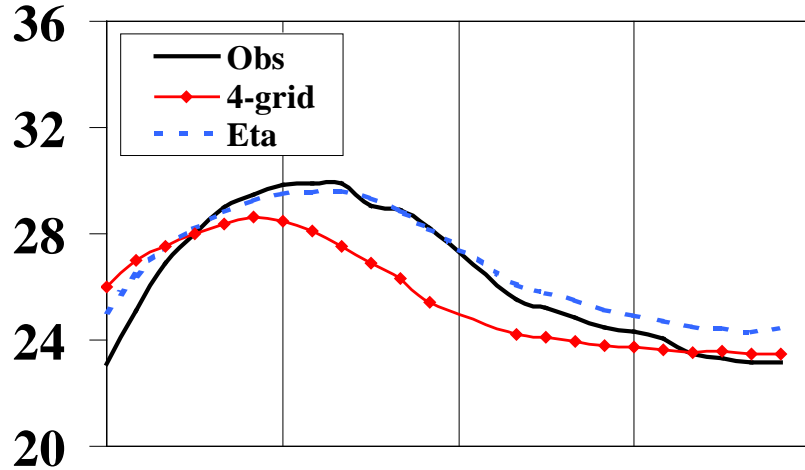


RMS Error: Completed Runs

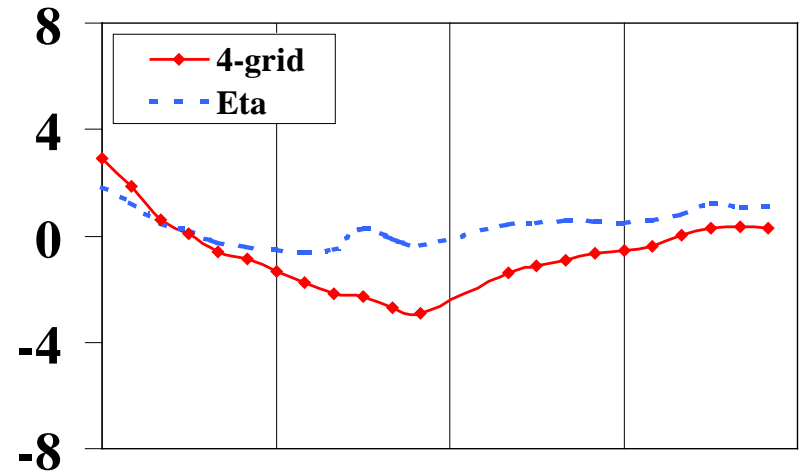


1200 UTC RAMS/Eta Cycle Temperature (°C, KTTS - Surface)

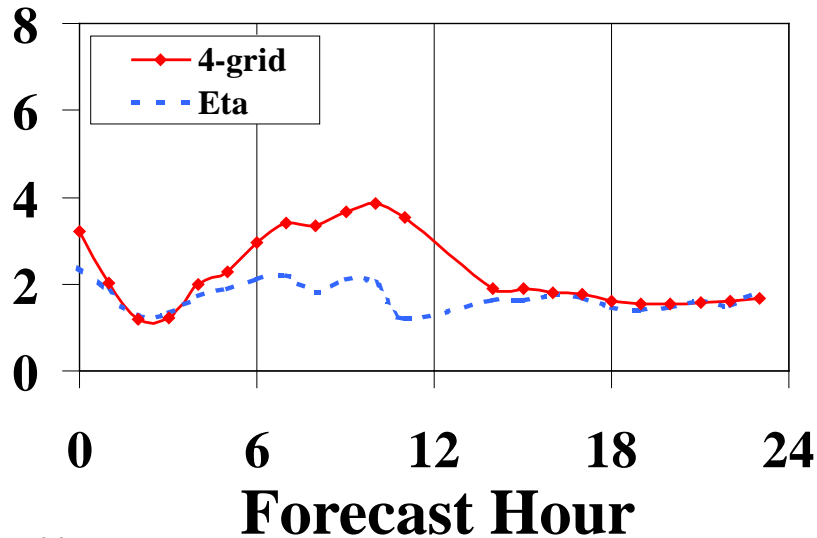
Mean Obs vs. Forecast



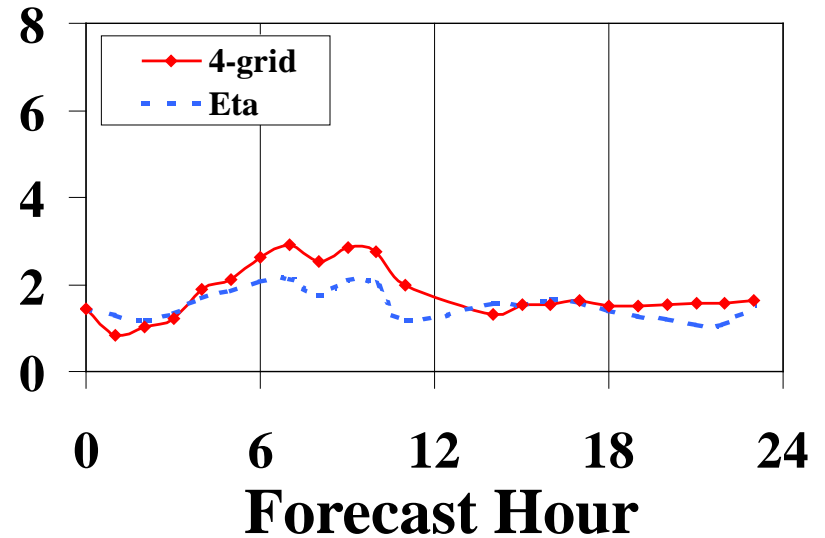
Bias



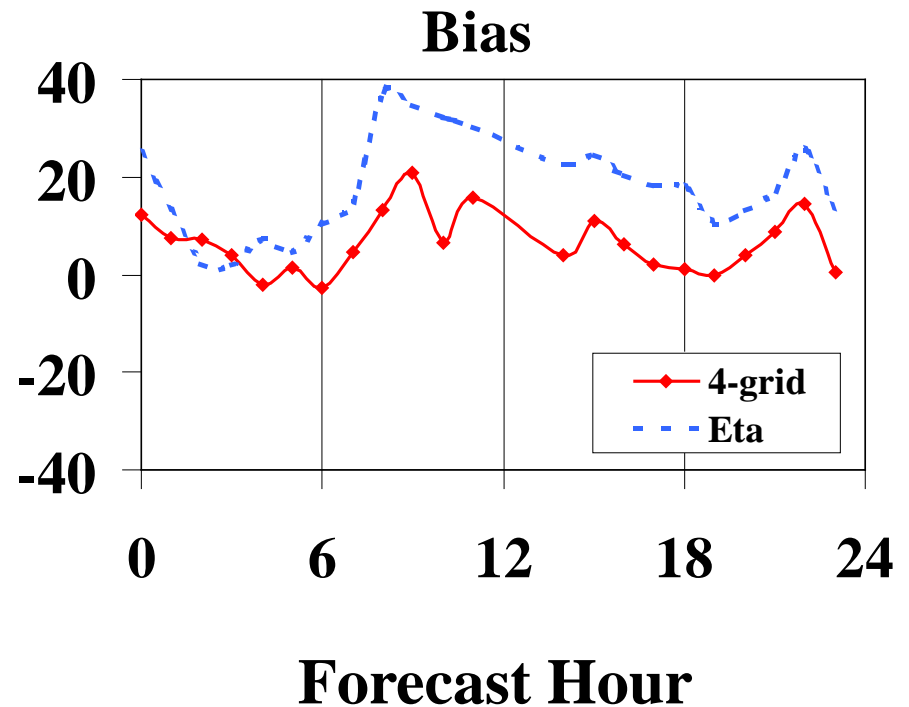
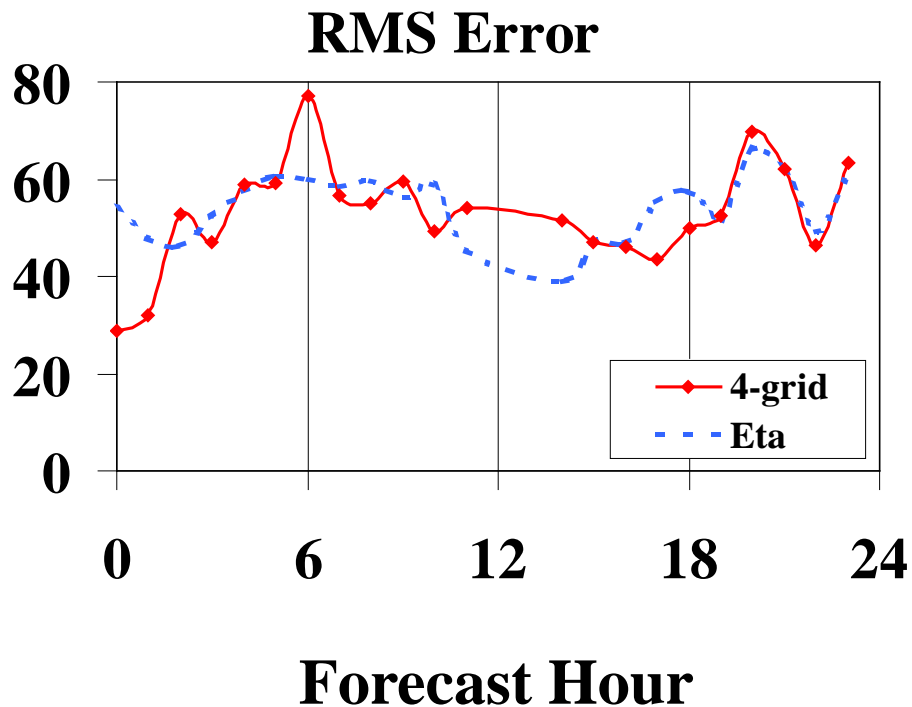
RMS Error



Standard Deviation



1200 UTC RAMS/Eta Cycle: Wind Dir (deg) (KTTS - Surface)



Ongoing / Future Work

- **1999-2000 cool-season verification**
 - Cold fronts and associated precipitation
 - Low temperatures and low-level inversions

- **2000 warm-season evaluation**
 - First thunderstorm of the day
 - Additional sea breeze verification
 - Precipitation verification

Summary

- **Cool, dry daytime bias (see paper for moisture verif.)**
 - RMS Error of 5 °C in 4-grid, 9 °C in 3-grid config.
 - Eta temps better due to RAMS cold bias
 - Moist bias in Eta (no moist bias in RAMS)

- **Wind Dir: 50-70° RMS error, Unbiased**
 - 15-20° observational variability (Merceret 1995)
 - Largest during nighttime hours (light wind regimes)
 - Smallest error in 4-grid config. during low-precip regimes
 - » Post sea breeze ~ 30-40° (low-precip regime)
 - » 15-25° model error (low-precip regime)
 - Anomalous precipitation forecasts → Large wind errors

Contacts

- **AMU Quarterly reports:**

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