WRF Meteorological Modeling Status for Houston

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Air Quality Division

Presented to the SETPMTC
April 13, 2011
Outline

- WRF configuration
- Preliminary WRF performance statistics
- Additional evaluation
- Future work
- Conclusions
- Questions
What is WRF, Again?

- WRF is the Weather Research and Forecast Model.
- WRF replaces the Fifth Generation Mesoscale Meteorological Model (MM5).
WRF Configuration

- New RPO map projection and new grids
- Physics options include:
  - YSU PBL scheme
  - Kain-Fritsch cumulus parameterization
  - WSM 6 microphysics
  - 5 layer thermal diffusion
- Nudging options include:
  - Gridded analysis nudging
  - Observational profiler nudging
  - Surface nudging
WRF Configuration and Testing

- Over 18 major runs and additional minor runs
- PBL options have included:
  - MYJ turbulent kinetic energy (1.5 order)
  - MYNN TKE (2.5 order)
  - YSU
- Cumulus schemes have included:
  - Grell-Devenyi (cumulus ensemble)
  - “New” Grell
  - Kain-Fritsch
- Land-use options have included:
  - NOAH LSM – including MODIS data
  - RUC
  - 5 layer thermal diffusion
Two Major Episodes

- Extended June 2006 – May 28 through July 3
  - Selected for high ozone days across several metropolitan areas
- The 2006 Intensive – in four pieces below:
  - 2006ep1a (August 13 through August 23)
  - 2006ep1b (August 27 through September 16)
  - 2006ep1c (September 16 through September 29)
  - 2006ep1d (October 1 through October 12)
## Daily Maximum Eight-Hour Ozone

**May 29 through June 15, 2006**

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## Daily Maximum Eight-Hour Ozone

### June 16 through July 2, 2006

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Wind Direction

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HGB Wind Direction

Houston–Galveston – Region 12 Average

Wind Dir deg

Bias Wind Dir deg

Mean Absolute Error Wind Dir deg

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HGB Wind Speed

Wind Speed m/s

Houston–Galveston – Region 12 Average

Bias Wind Speed m/s

Mean Absolute Error Wind Speed m/s

LST

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HGB Wind Direction
2006ep1b

Wind Dir deg
Houston—Galveston — Region 12 Average

Bias Wind Dir deg

Mean Absolute Error Wind Dir deg

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HGB Wind Speed
2006ep1b
HGB Wind Speed
2006ep1c

Wind Speed m/s
Houston–Galveston – Region 12 Average

Bias Wind Speed m/s

Mean Absolute Error Wind Speed m/s

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Future Work

- Preliminary analysis of regional statistics and focus on wind speed and direction are well underway.
- Evaluation will shift to daily specific performance at key monitors.
- Evaluation will expand to clouds, precipitation and other variables.
Comparison: Cloud Fraction and Cloud Optical Depth

GOES Cloud Cover Fraction
Jun 09, 2006 Hour 12

Cloud Optical Depth (Layer 1)

MM5CAMx: 2006ep0ext_Slayer_YSU_WSM6_3dsfc3h_fddat:
May 28 - July 02 2006

June 9, 2006 12:00:00
Min = 0.0 at (2.2), Max = 80.8 at (50.35)
WRF Fractional Cloud Coverage at Low Levels
Conclusions

- Several WRF sensitivities testing model configuration and nudging have been performed.
- Updates and improvements will be provided as they become available.
- Thanks to Khalid Al-Wali for several WRF runs focusing on surface nudging sensitivities and graphics.
Questions?

Contact Information:
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bdornbla@tceq.state.tx.us