



An Operational Configuration of the ARPS Data Analysis System to Initialize WRF in the NWS Environmental Modeling System

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Jonathan L. Case¹,
Peter Blottman²,
Timothy Oram³, and Brian Hoeth³

¹ENSCO Inc., Cocoa Beach, FL

²NOAA/NWS Melbourne, FL

³NOAA/NWS Spaceflight Meteorology Group (SMG)



Outline



- Goal: Use high-resolution ADAS analyses for initializing regional WRF forecasts
- Regional modeling “primer”
 - What’s needed to run a local model?
 - “Hot start” concept for regional modeling
- NWS Environmental Modeling System (EMS)
- ADAS to initialize WRF: Why bother?
- Benefits of ADAS in EMS
- Gory details: See me
 - Implementation of ADAS in EMS to initialize WRF



Regional Modeling “Primer”



- What is required to run a regional model like WRF?
 - Static fields
 - Terrain height, soil type, vegetation, etc.
 - These data are available with WRF
 - Initial and lateral boundary conditions
 - Usually come from an existing NWP model (e.g. NAM, GFS)
 - Advects information in at N/S/E/W edges of WRF grid
- What is optional but highly desired?
 - High-resolution initial conditions at regional model’s resolution
 - ADAS, LAPS, or variational analysis scheme
 - High-resolution, accurate lower boundary data
 - Satellite-derived sea-surface temperature (e.g. MODIS)
 - Accurate land-surface data (e.g. soil temperature/moisture)



“Hot Start” Concept

- Cold start regional NWP model run
 - Running model with only required fields
 - No small-scale features present initially
 - Few hours of spin-up needed to generate precipitation & high-resolution features
 - Primary benefit is higher resolution producing local circulations
- Hot start regional NWP model run
 - Running model with high-resolution initial condition
 - Adjustments to wind, temperature, and moisture fields
 - Reflectivity and satellite IR converted to model precip & cloud fields
 - Preserves mesoscale and convective features in short-term
 - No need for “spin-up”; precipitation occurs almost right away
 - Fills gap between “nowcasting” and large-scale NWP
 - Computationally simple compared to variational data assimilation



Environmental Modeling System



- NWS SOO Science & Training Resource Center (STRC)
 - Author: Robert Rozumalski (Fantastic job!)
- All-inclusive software for running WRF with ease
 - Pre-compiled executable programs for any linux architecture
 - Automatically fetches boundary condition data from the web
 - Can run both versions of WRF (NCAR and NCEP)
 - Post-processing utilities built-in
 - GEMPAK, GrADS, AWIPS-formatted files, BUFR
 - Can post-process data while WRF model runs!
 - Sets up capability to run real-time forecast at installation
- Available to NWS offices

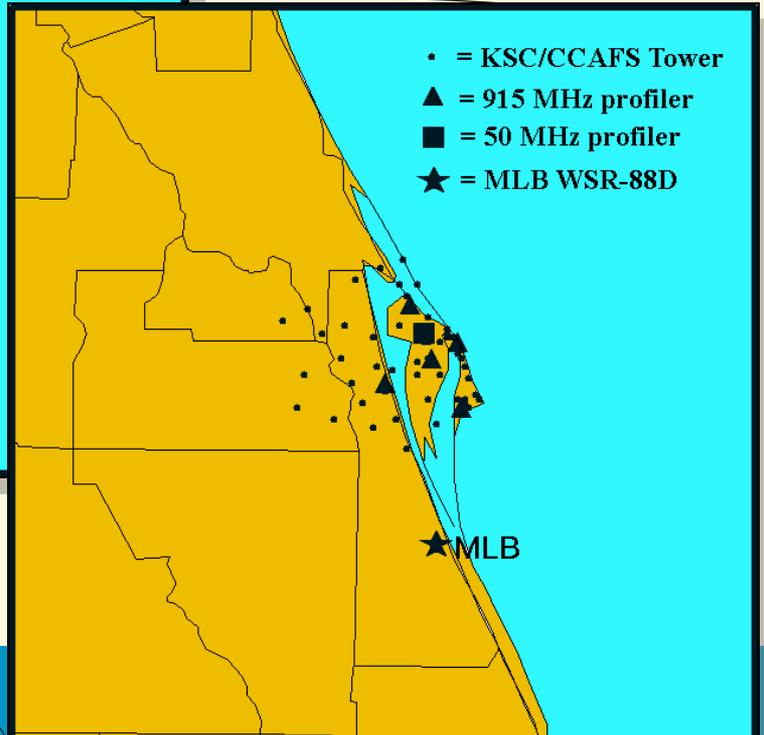
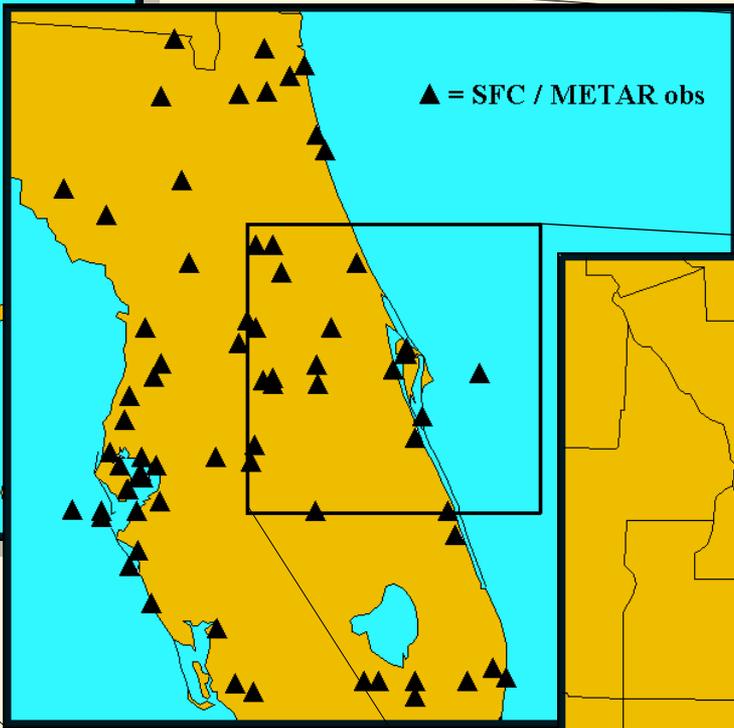
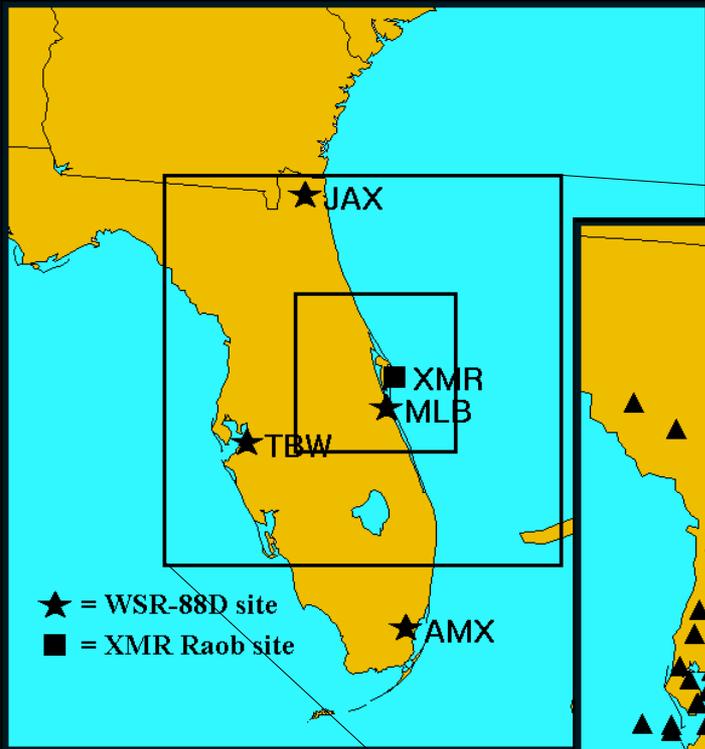


ADAS initializing WRF in EMS: Why should we care?

- Objective: Improved short-term NWP
- Added value of ADAS initial condition:
 - Assimilation of all operationally-available local/regional data
 - Surface obs, mesonets, satellite, radar, etc.
 - Provides mesoscale “snapshot” of the atmosphere for WRF
 - Already operational at NWS Melbourne, FL and SMG
 - High temporal (15 min) and spatial resolution (4 km) output
 - Visualization, Time Animation, & Prognostics not currently available with national models
- Result: Regional, high-resolution model guidance to support 0-12 hour forecast decisions

Observational Data Sets Ingested

- **Analysis frequency: Every 15 minutes**
- **Data Analyzed: Surface, Local Obs, Satellite, WSR-88D Level II, Aircraft (ACARS)**

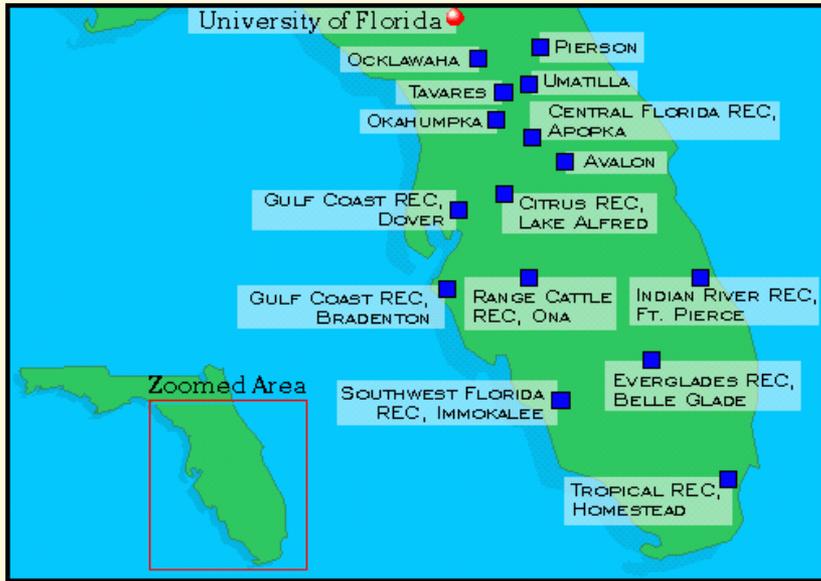




Observational Data Sets, cont.



FAWN: fawn.ifas.ufl.edu
(Florida Automated Weather Network)



APRS: www.findu.com/aprswxnet.html
(Automatic Position Reporting System)

- Amateur Radio Operators
 - Volunteered weather data
 - Data collected by NOAA/GSD server
 - NWS MLB obtains data from GSD
- Surface Observations
 - Temperature, dew point temperature
 - Winds and altimeter setting

ACARS: acweb.fsl.noaa.gov

- Commercial Aircraft Observations
 - Temperature and winds
 - Variable coverage and availability
 - NWS MLB obtains data from GSD



ADAS initializing WRF in EMS: Why should you care?

- Forecasters could use additional guidance for short-term mesoscale weather prediction
 - Summertime air mass thunderstorms: Where will they initiate?
 - Terrain-induced circulations unique to specific regions
 - Localized mesoscale winter weather phenomena
- ADAS produces good representation of mesoscale atmosphere
 - ADAS is easy to configure and run
 - Applied Meteorology Unit (AMU) has detailed documentation
- Most anyone can run a regional WRF model run today
 - Computer hardware is relatively cheap
 - WRF EMS software does all the hard work for the user



Benefits of ADAS in EMS

- ADAS can initialize either version of WRF
 - Without EMS, ADAS can only initialize the NCAR WRF (ARW)
 - Within EMS, ADAS can also initialize the NCEP WRF (NMM)
 - NMM WRF → Runs 2.5 times faster than ARW
- NWS Melbourne & SMG can leverage off operational ADAS
 - Ingests all local and regional data sets
 - Already runs operationally → Simply plug in analyses into EMS
- Provides “hot start” capability to WRF
 - Full initialization of model wind, cloud, and precipitation fields
 - GSD code modifications from LAPS to be implemented in EMS



Summary



- Background on regional modeling
 - Required and desired features
- Cold start vs. hot start model runs
 - Why hot start is better
- NWS Environmental Modeling System
 - Very streamlined, easy-to-use software for running WRF
- Running ADAS to initialize WRF EMS makes sense
 - Allows users to initialize either version of WRF with ADAS
 - Plug-and-play ADAS/WRF at NWS Melbourne and SMG
- Questions?
- AMU Web page: <http://science.ksc.nasa.gov/amu>