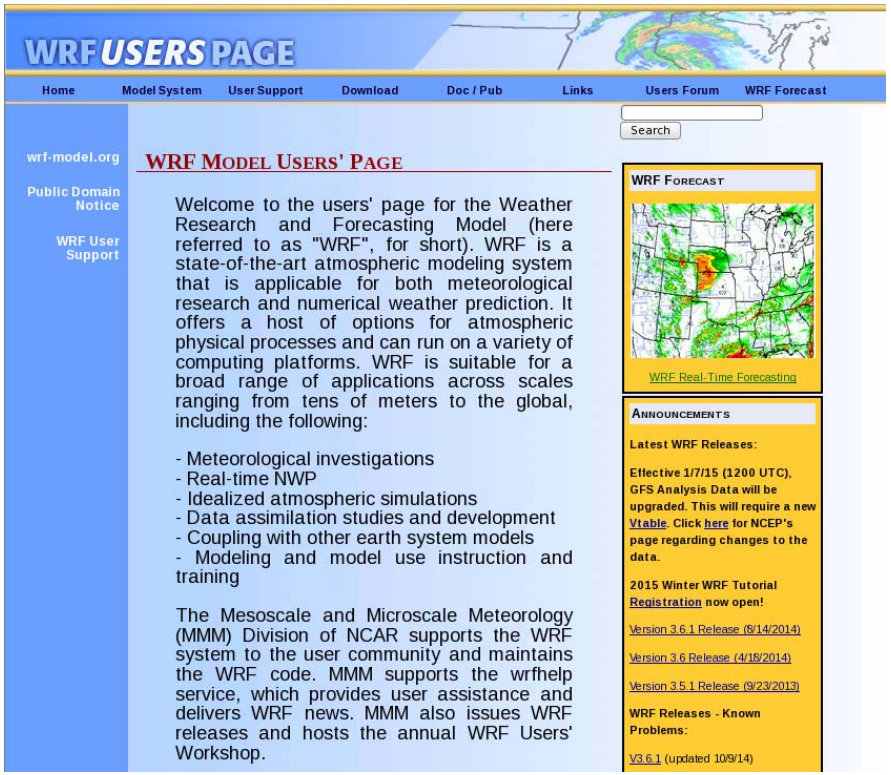
WRF
The Weather Research and Forecasting Model

- **Numerical weather prediction capability designed for:**
  - Research
  - Operational forecasting
- **Community Model**
  - A free resource with development from a variety of scientists and software engineers
  - Contributions provided by a large user community.
  - Community support provided by the National Center for Atmospheric Research (NCAR**)**

WRF History

- **Background**
  - Initial ideas—1995
  - First public release— 2000
  - Next release (April)— WRF Version 3.7
  - June 2014— 15th WRF Users' Workshop (att. 225)
- **Initial WRF Partners**
  - **NCAR**
  - **Air Force Weather Agency (AFWA)**
  - National Centers for Environmental Prediction (NCEP)
  - Federal Aviation Administration
  - U.S. Navy— Naval Research Lab
  - NOAA Earth System Research Lab (ESRL)
  - Oklahoma University



WRF Users' Page

www2.mmm.ucar.edu/wrf/users

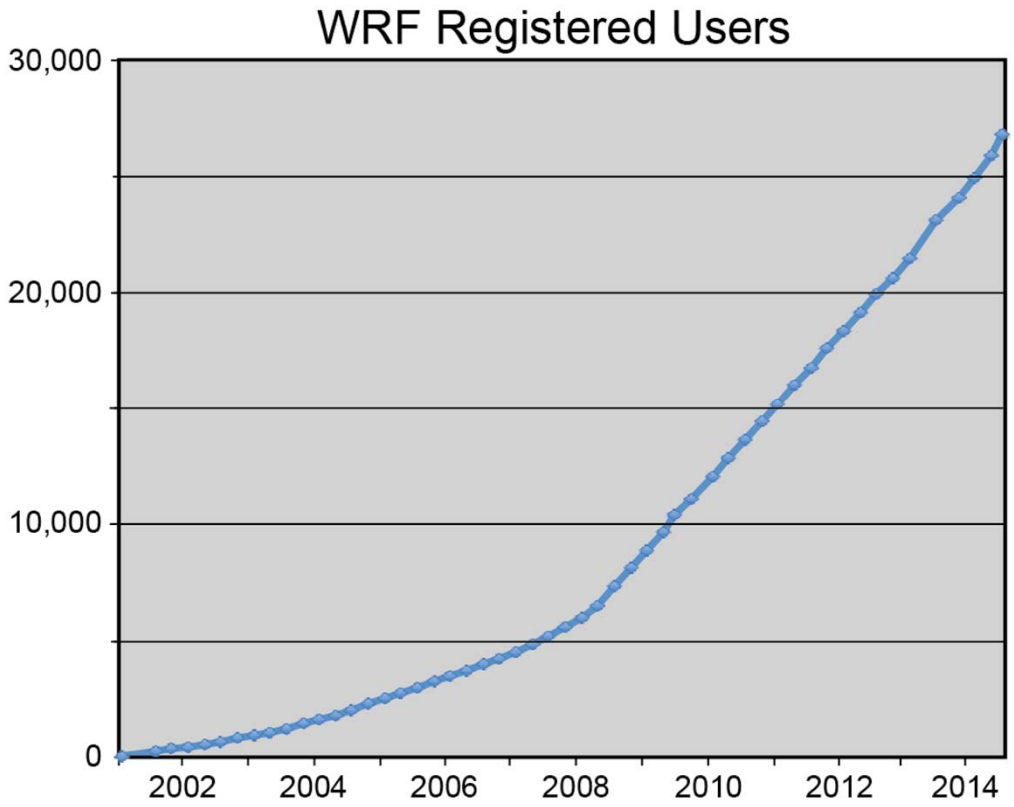
WRF User Participation

Registered Users
(June 2014)

U.S. Universities	5,638
U. S. Gov't labs, Private sector	2,494
Foreign users	18,718

	26,850

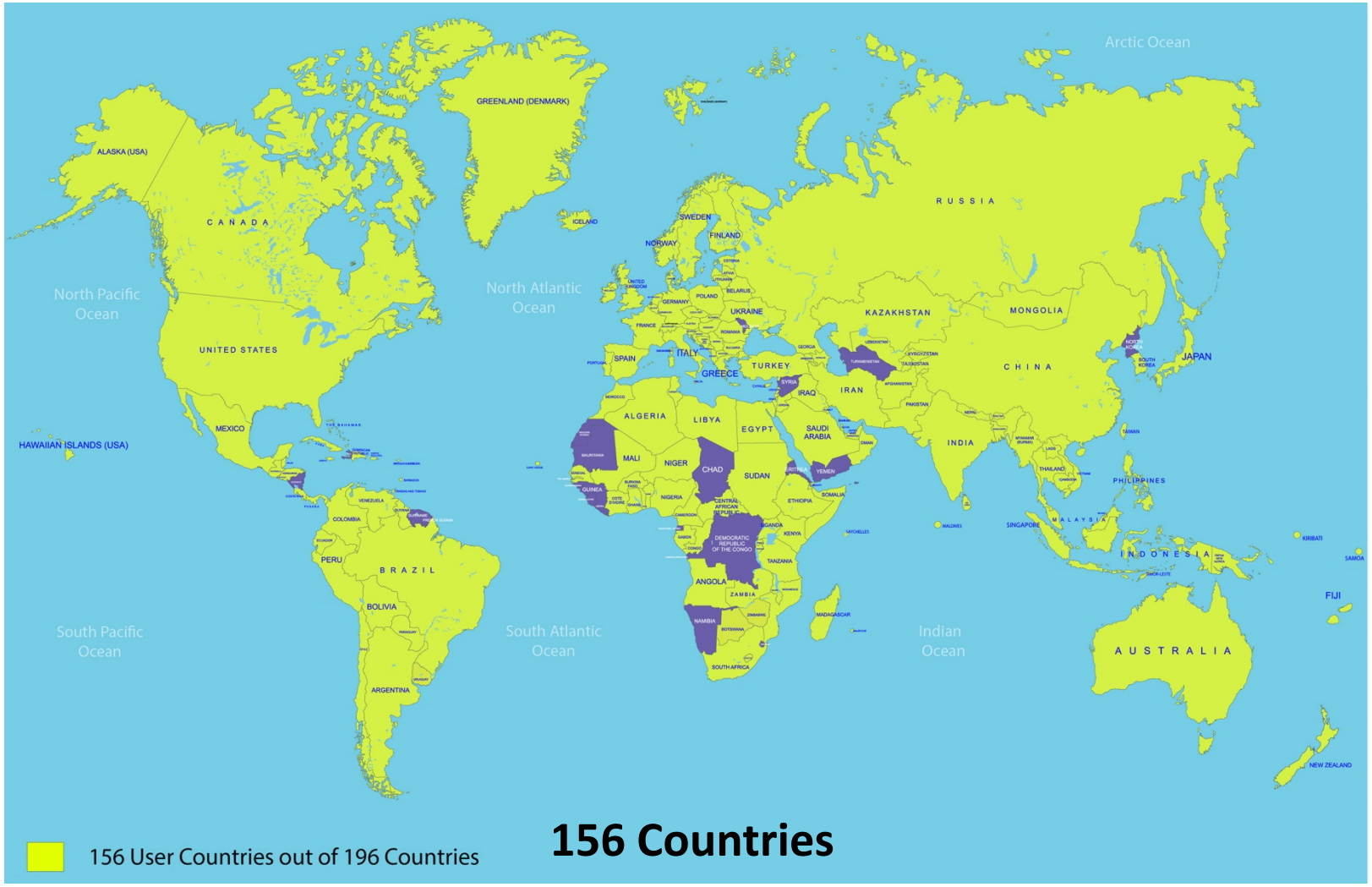
Countries represented: 156



November 2014 registered users: 28,355

Active subscribers to wrf-news@ucar.edu: >8,250

WRF Registered User Countries



WRF for HAIC/HIWC

Four 48-h forecasts per day

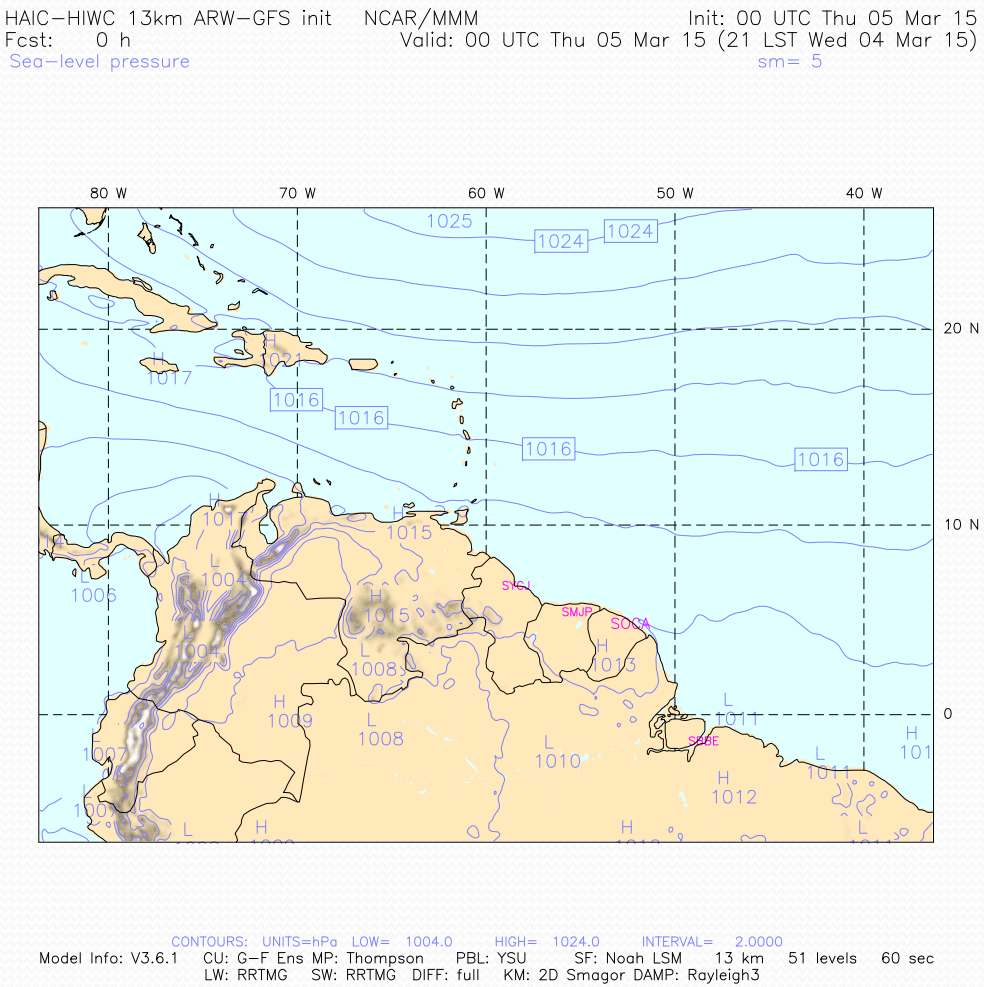
400 x 284 x 52 grid

dx = 13 km

Model top of 30 hPa

Initial and lateral boundary conditions provided by NCEP/GFS

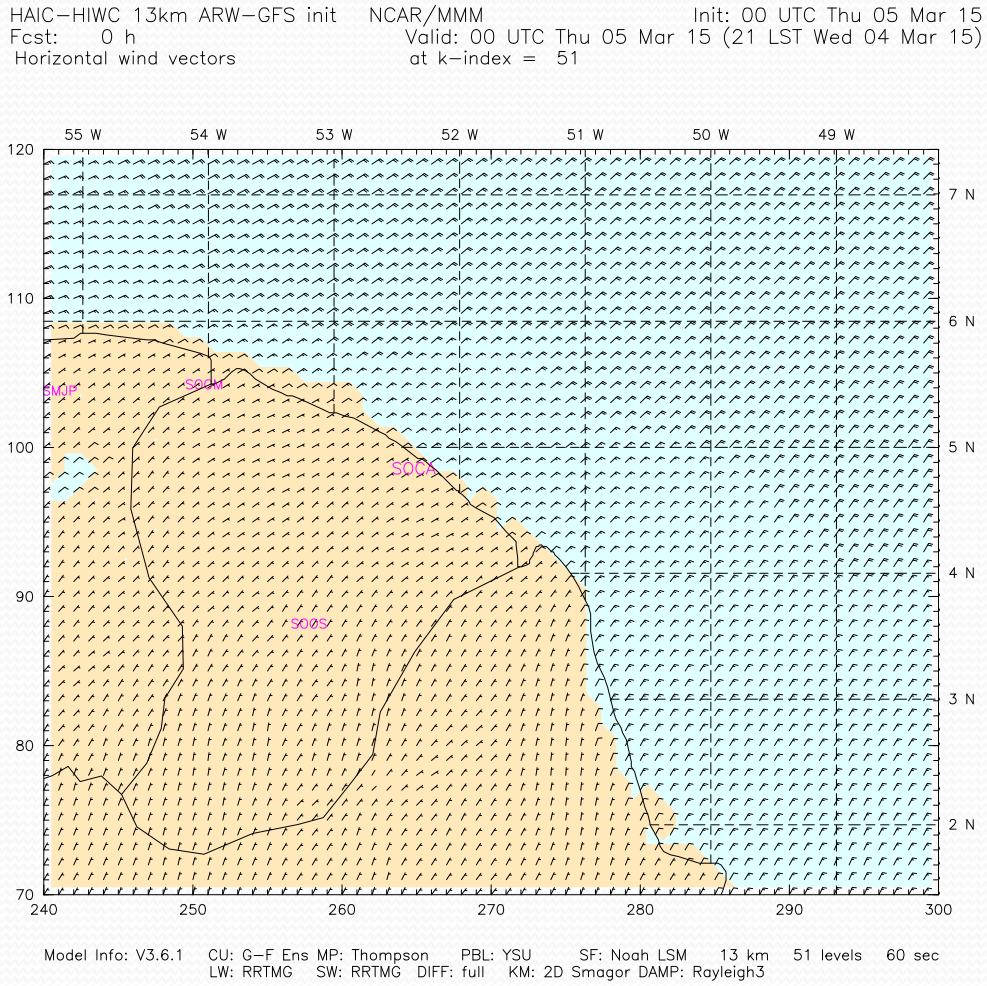
Scheduling still needs to be worked out, but the plots/output are usually available about 5 hours after synoptic time.



WRF for HAIC/HIWC

Zoom of the flight operations region showing the full model resolution.

Wind barb located at every model grid point.



Strengths and Weaknesses of WRF

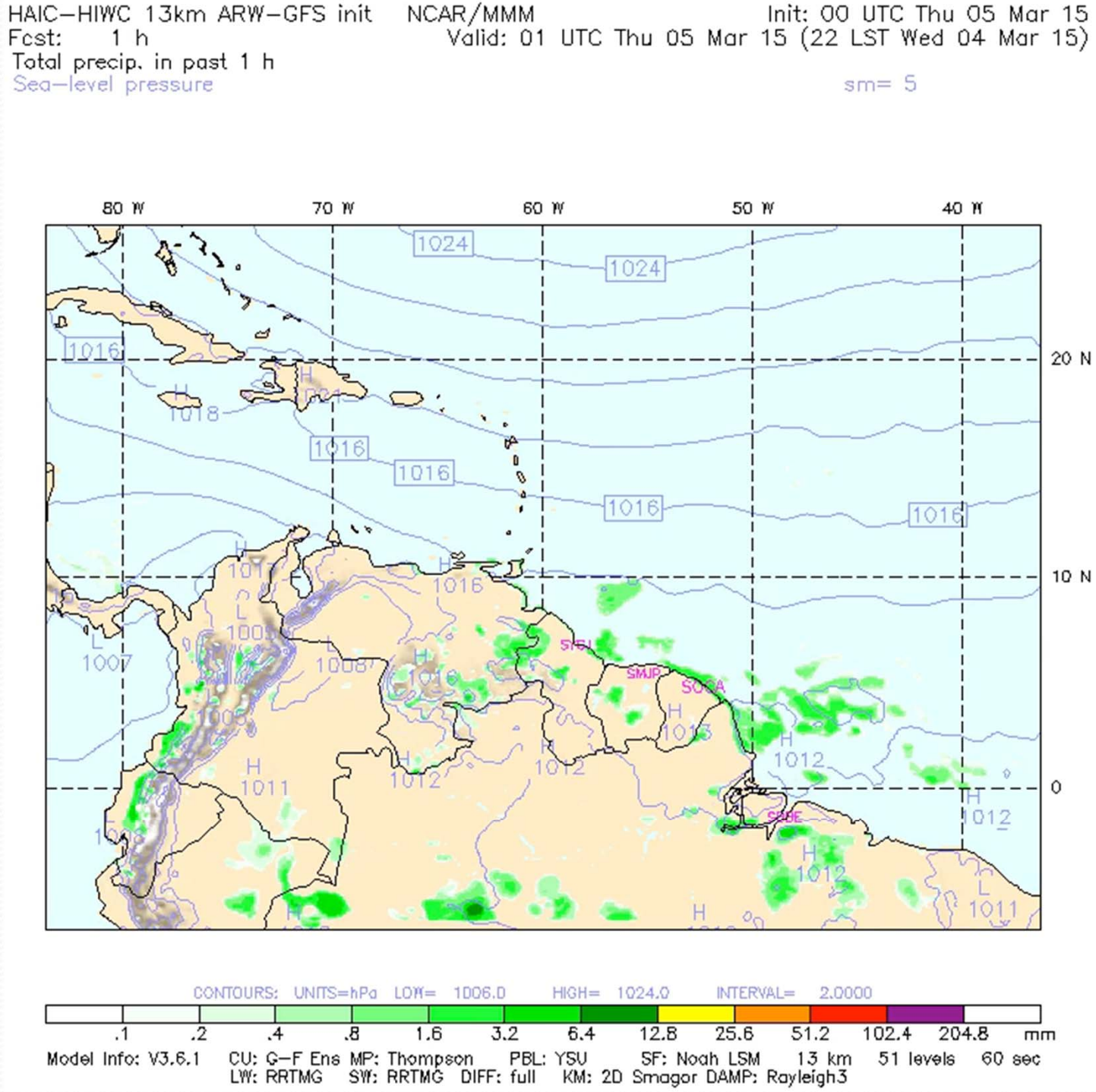
Strengths:

- Regional domain allows higher resolutions than the global models.
- State-of-the-art physics that can be optimized for the region of interest.
- Accurate numerics and dynamics.
- Higher-frequency and customized output fields.
- WRF is widely-used, extensively-tested and is robust.

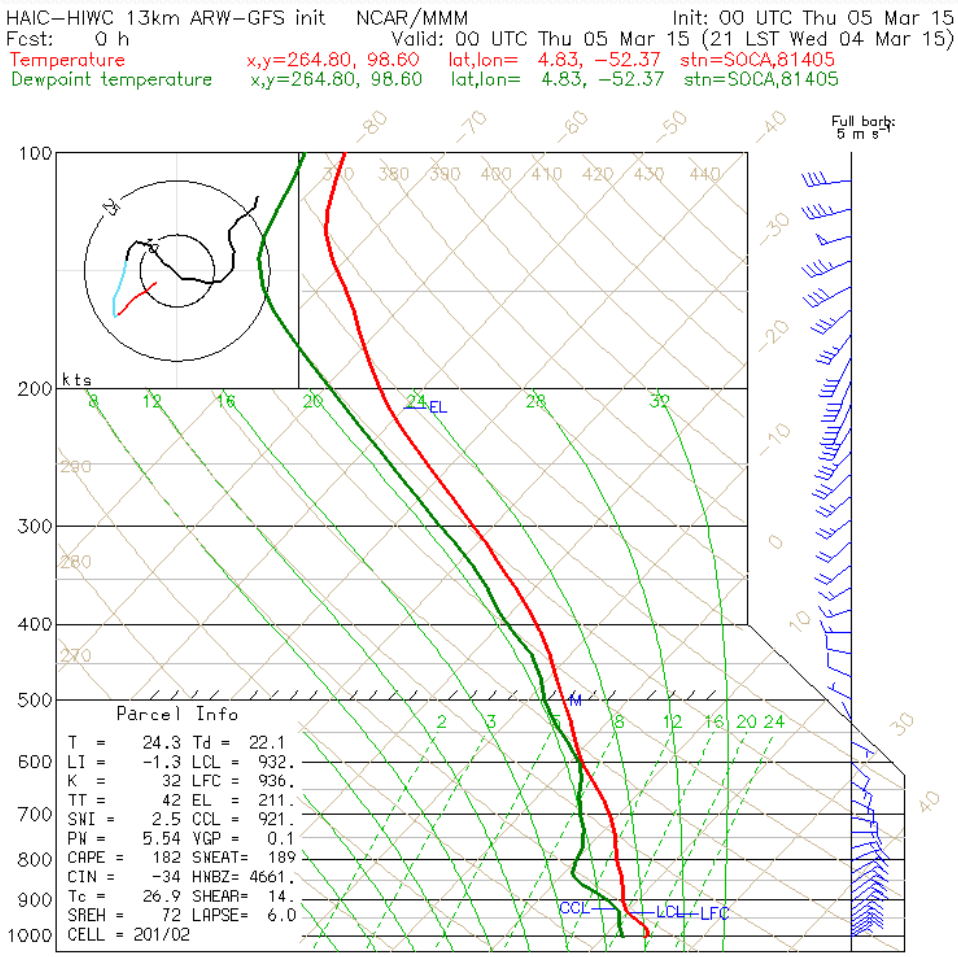
Weaknesses:

- Regional models such as WRF require lateral boundary conditions which can introduce error.
- Initialization is not as good as those the operational global centers can produce especially over the tropical oceans.
- Microphysics parameterizations have biases (e.g. too much ice vs. too much snow).
- Tropical convection is weakly-forced and a model can have trouble with the details (i.e. timing, location, intensity).

Rainfall animation



Sample WRF output plots



Skew-T plot with wind barb at every model level

Profile of microphysics components

Preliminary list of WRF products in the field catalog

- 150 hPa winds/temperature
- 300 hPa winds/temperature
- 500 hPa winds/temperature/vorticity
- 700 hPa winds/temperature/Vertical velocity
- 850 hPa winds/temperature/relative humidity
- CAPE
- ceiling
- cirrus (150 and 200 hPa RH)
- 12-km cloud mixing ratio
- 15-km cloud mixing ratio
- total cloud cover
- cloud-top temperature
- surface temperature
- surface dewpoint
- surface theta_e
- surface wind speed
- 3-h precipitation and SLP
- accumulated precipitation
- convective and non-convective precipitation product
- simulated reflectivity
- precipitable water
- Forecast soundings
- Surface meteograms for operations base and alternate airports
- north-south and west-east cross sections of hydrometeors
- north-south and west-east cross sections of RH

Plots can be customized for HAIC users (e.g. levels, variables, colors)