16th Weather Squadron

Presented by Burkely Gallo, 22 August 2023

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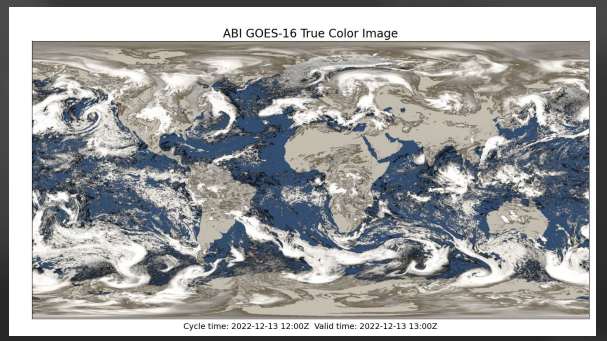
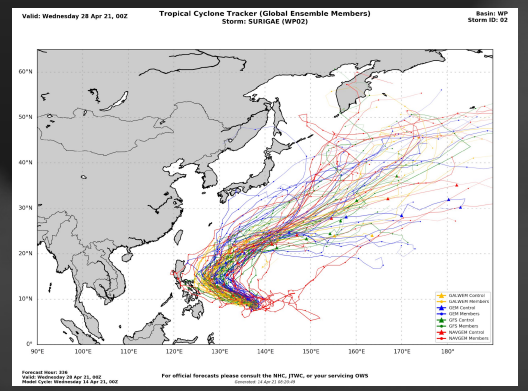
16th Weather Squadron

Mission: Automate environmental information insights for national security decision advantage

Source: U.S. Navy / Seaman John Ciccarelli

Foundational secure environmental modeling 24/7 for Joint Forces providing 200 TB of data and 200M products to 20K users annually





Operationally responsive model/product adaptations and prototypes for evolving decision needs

MPAS Model for Prediction Across Scales

NASA Land Information System LIS

WRF

python

aws

Unified Model

GitLab

Environmental science and information technology expertise base for the Air Force Weather enterprise

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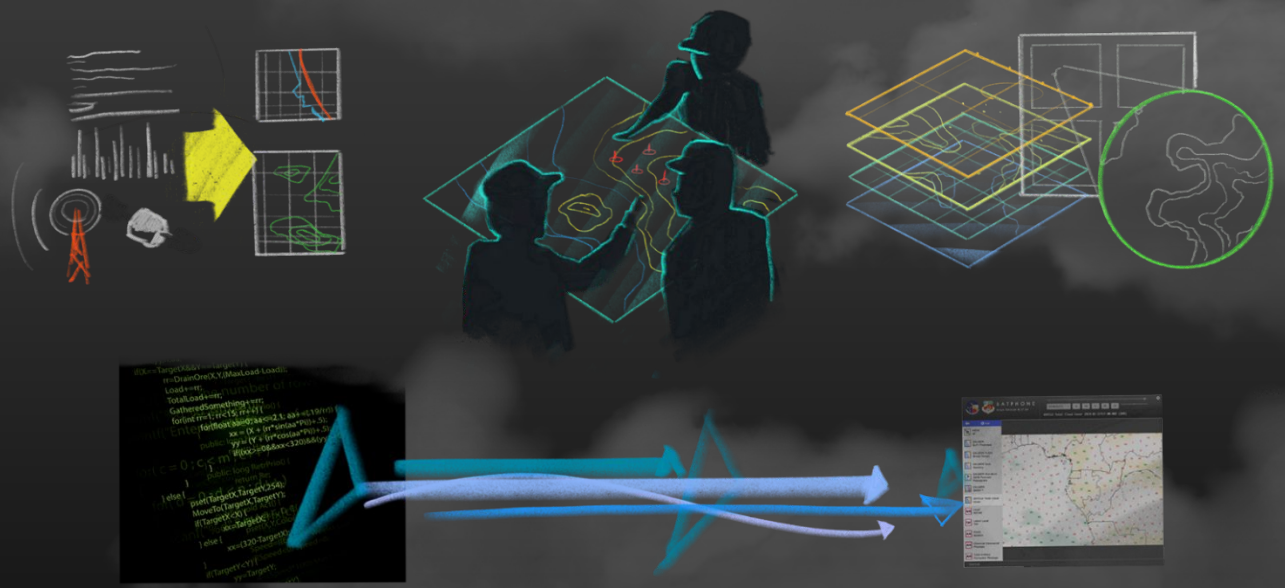
Mission



Automate environmental information insights for national security decision advantage

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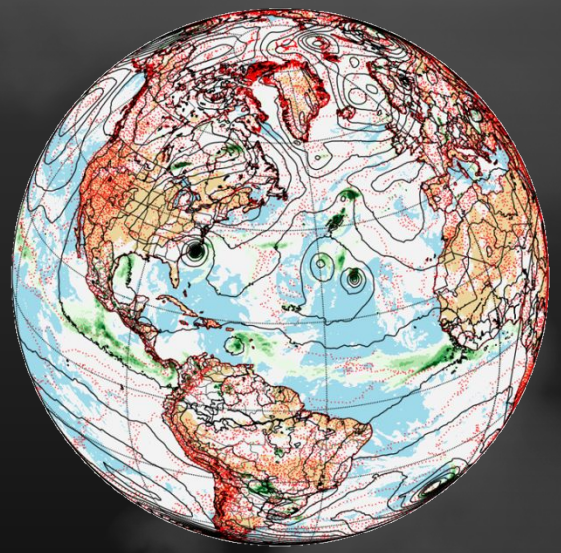
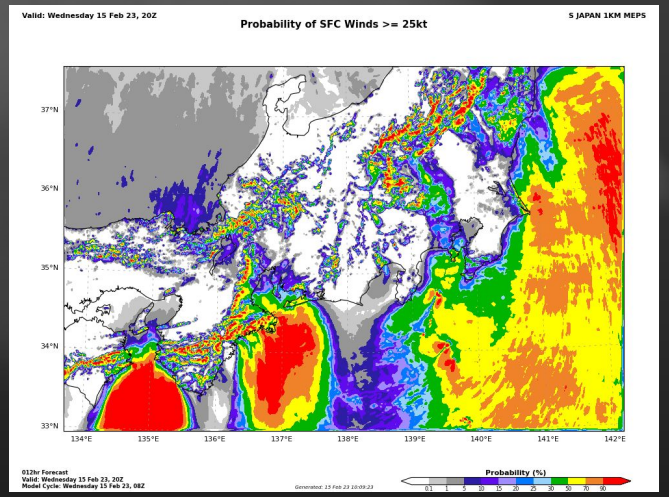
Mission

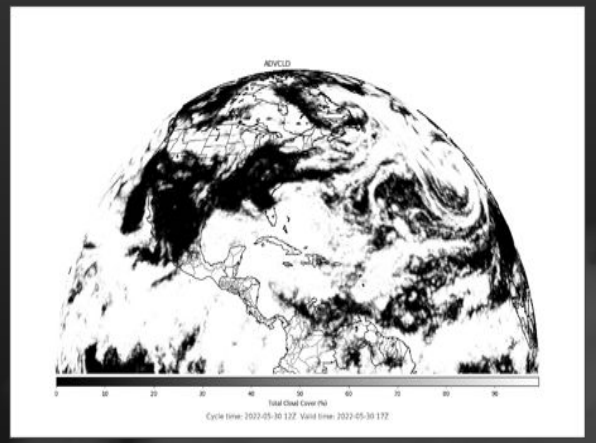
Global land surface and atmospheric analysis and forecasts to 16 days





Fine scale 1 km (30 hrs) and 4 km (72 hrs) regional environment forecast enhancements

Rapidly updating global cloud analysis and forecasts

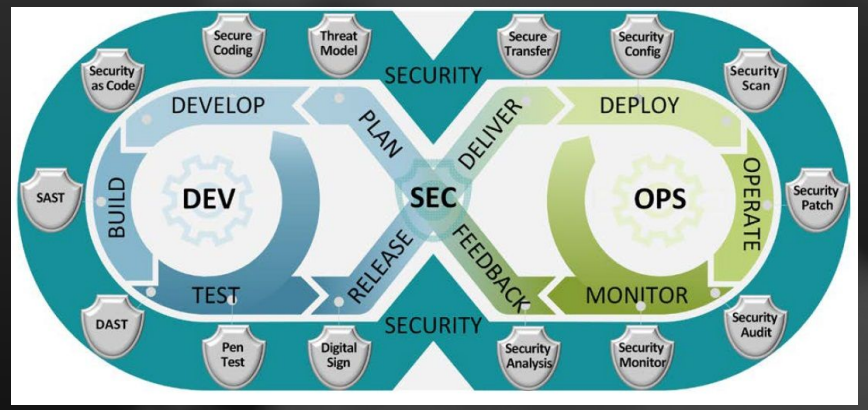


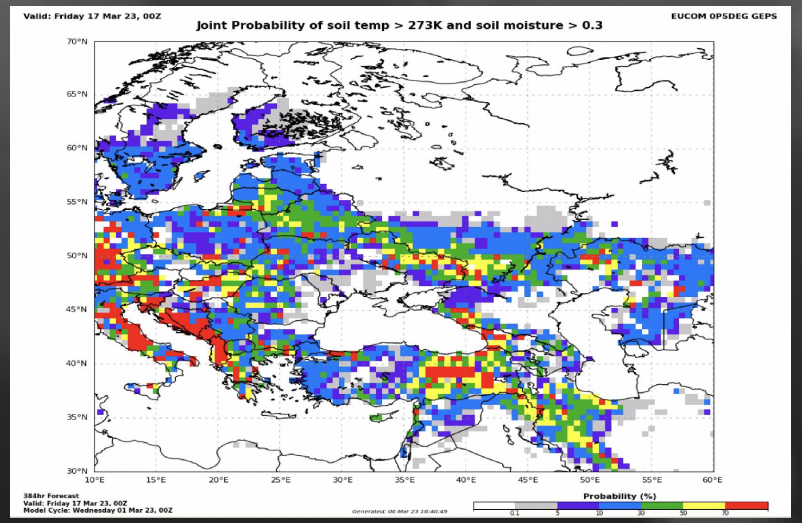
Government leaders for operational environmental modeling forecast skill and cyber security

Foundational secure 24/7 environmental modeling for Joint Forces providing 200 TB of data and 200M products to 20K users annually

Mission

Continuous Integration / Continuous Delivery of automated enhancements (transient or permanent) via software DevSecOps



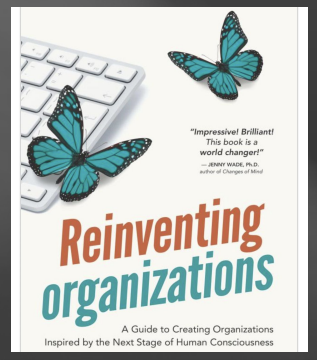


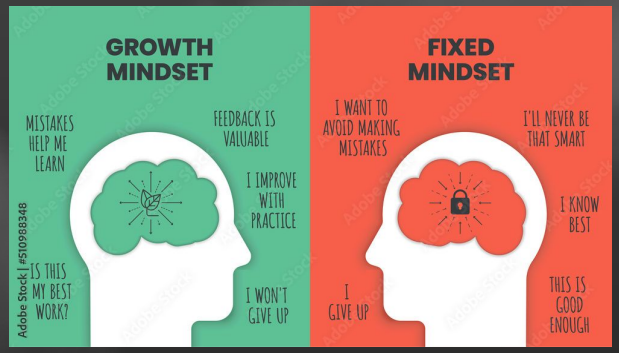
Collaboration of users (via stakeholder engagement team), scientists, and coders to innovate effective operational product adaptations

Operationally responsive model/product adaptations and prototypes for evolving decision needs

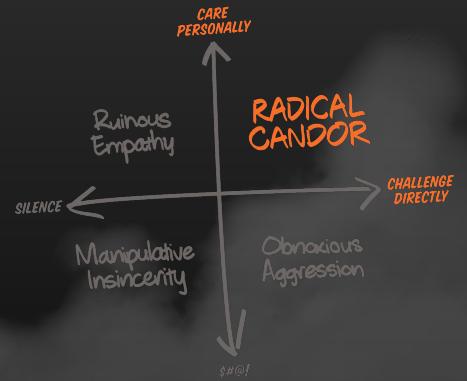
Mission

Provide operational insights and subject matter expertise to supporting commands/program offices





Educate supported Joint Forces on optimal use of 16 WS capabilities and ways to leverage its resources



Heavy emphasis on hiring and developing the right people/skills for complex and challenging mission

Environmental science and information technology expertise base for the Air Force Weather enterprise

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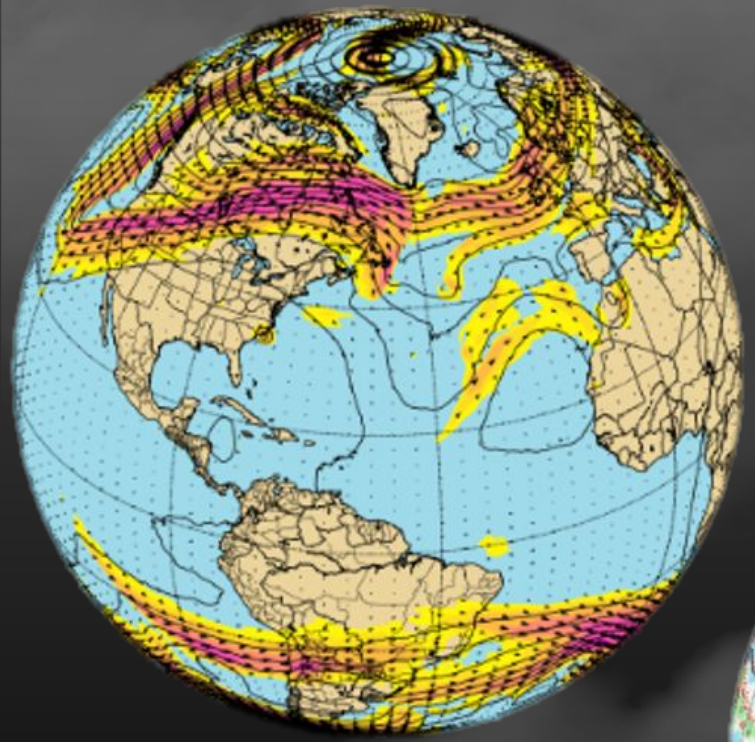
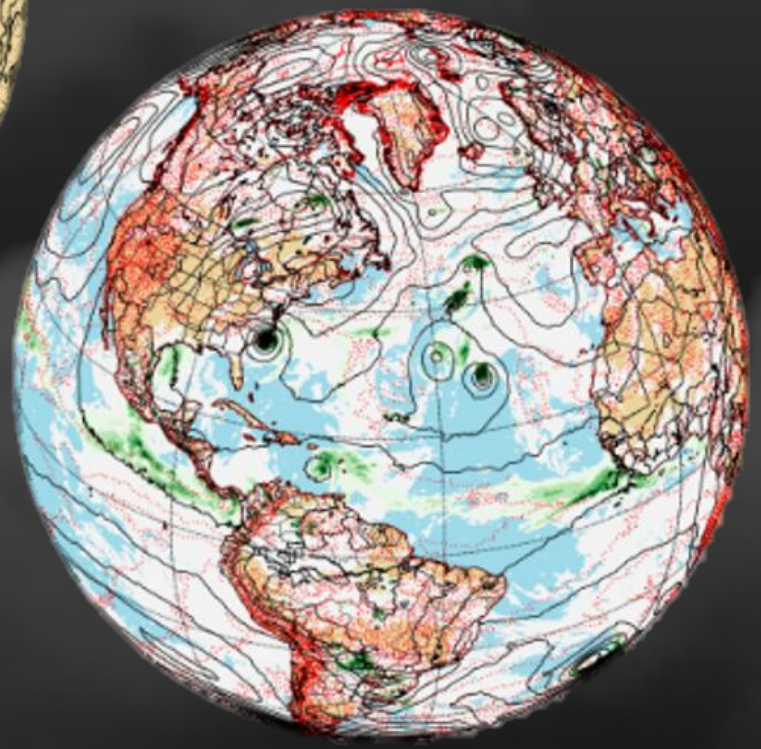
GALWEM





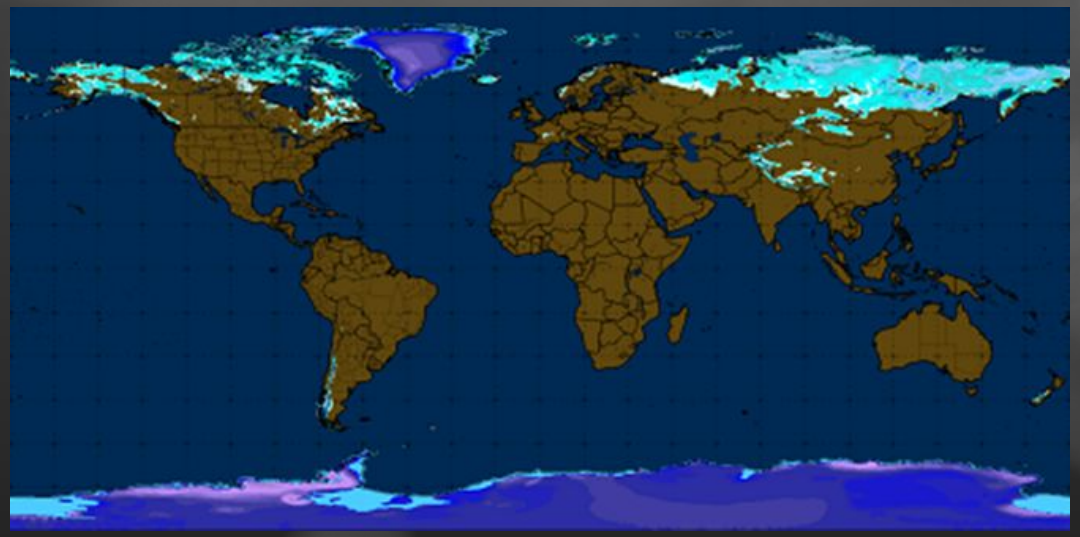
Global Air-Land Weather Exploitation Model

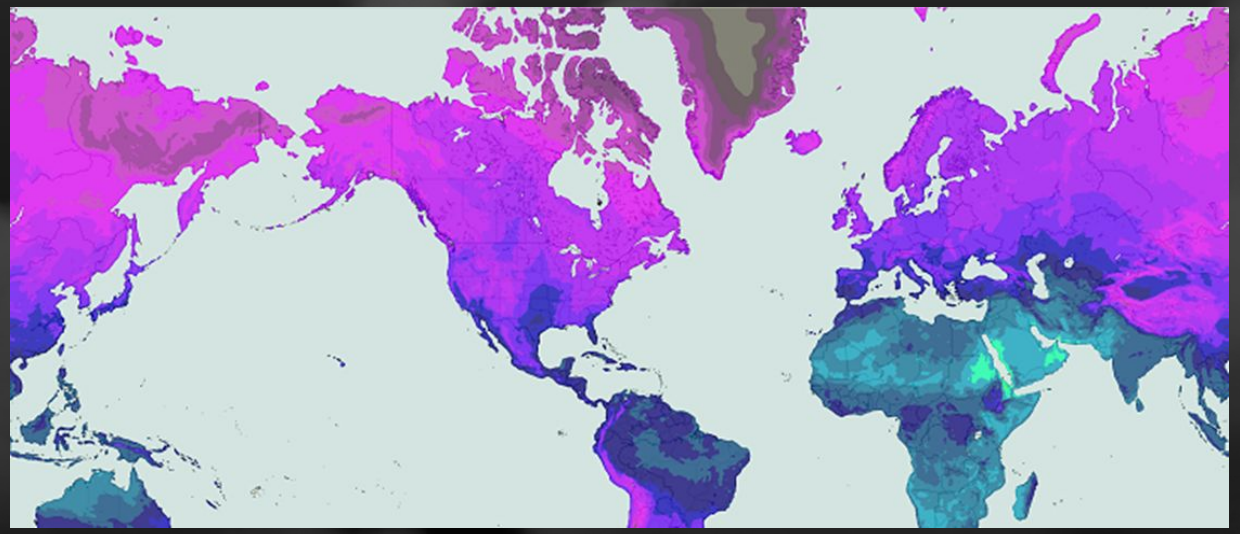
- 4X/day 17 km deterministic run to 240 hours
- 4X/day 20 km 18-member ensemble to 384 hours
- 70 vertical levels, 80 km model top
- Initial conditions provided by UKMO
- Post-processing/tailoring to create ~2500 output variables

LIS

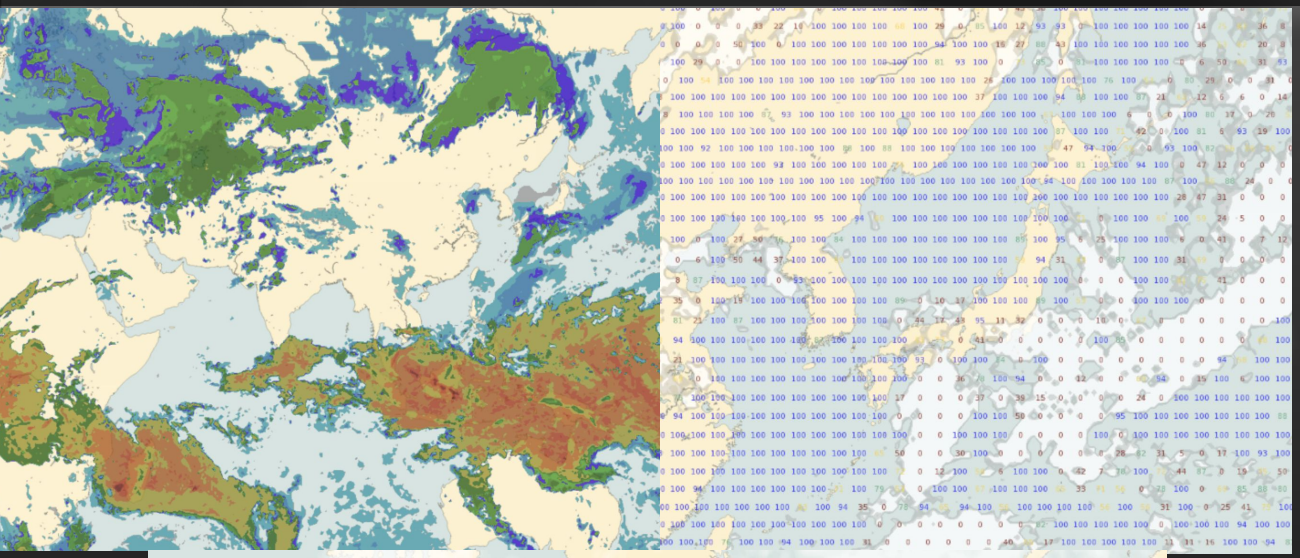
Land Information System

- 4X/day 10-km soil temperature, soil moisture, ice, and snow analysis
- Inputs from satellites, precipitation measurements, WWMCA, and global models
- Advanced assimilation techniques to maximize available data and model outputs





WWMCA, ADVCLD, DCF



WorldWide Merged Cloud Analysis

- Inputs from geostationary and polar orbiting satellites, land surface/ice analysis, and numerical weather prediction
- Cloud analysis products produced every 30 minutes
- Satellite inputs human-tuned to mitigate seasonal biases

ADVection of CLouDs (ADVCLD)

- Uses global model winds to move WWMCA clouds
- Hourly forecasts to 12 hours

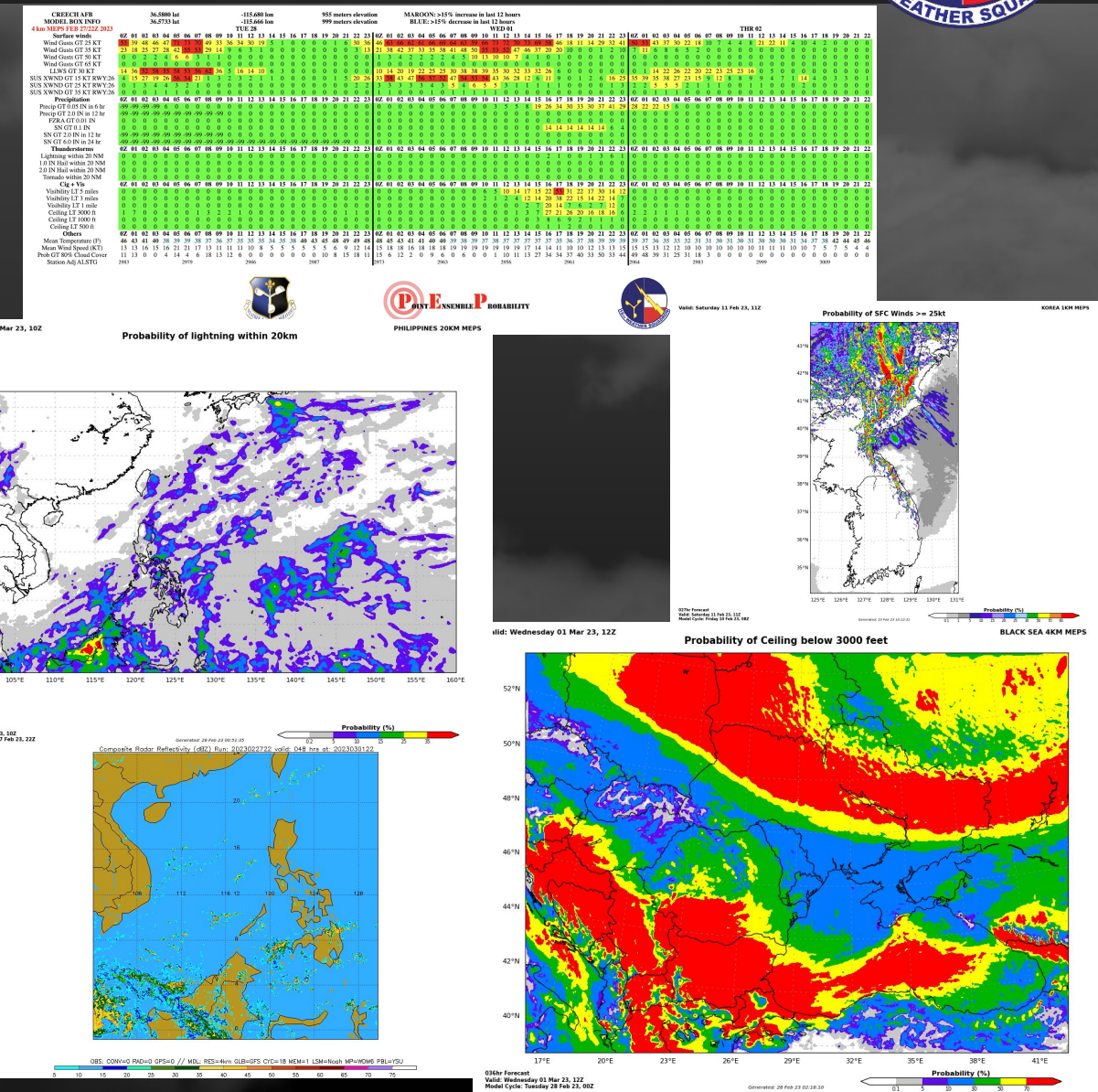
Diagnostic Cloud Forecast

- Statistical correction of global model predictors to create a product with similar characteristics to WWMCA
- 3-hourly forecasts to 144 hours

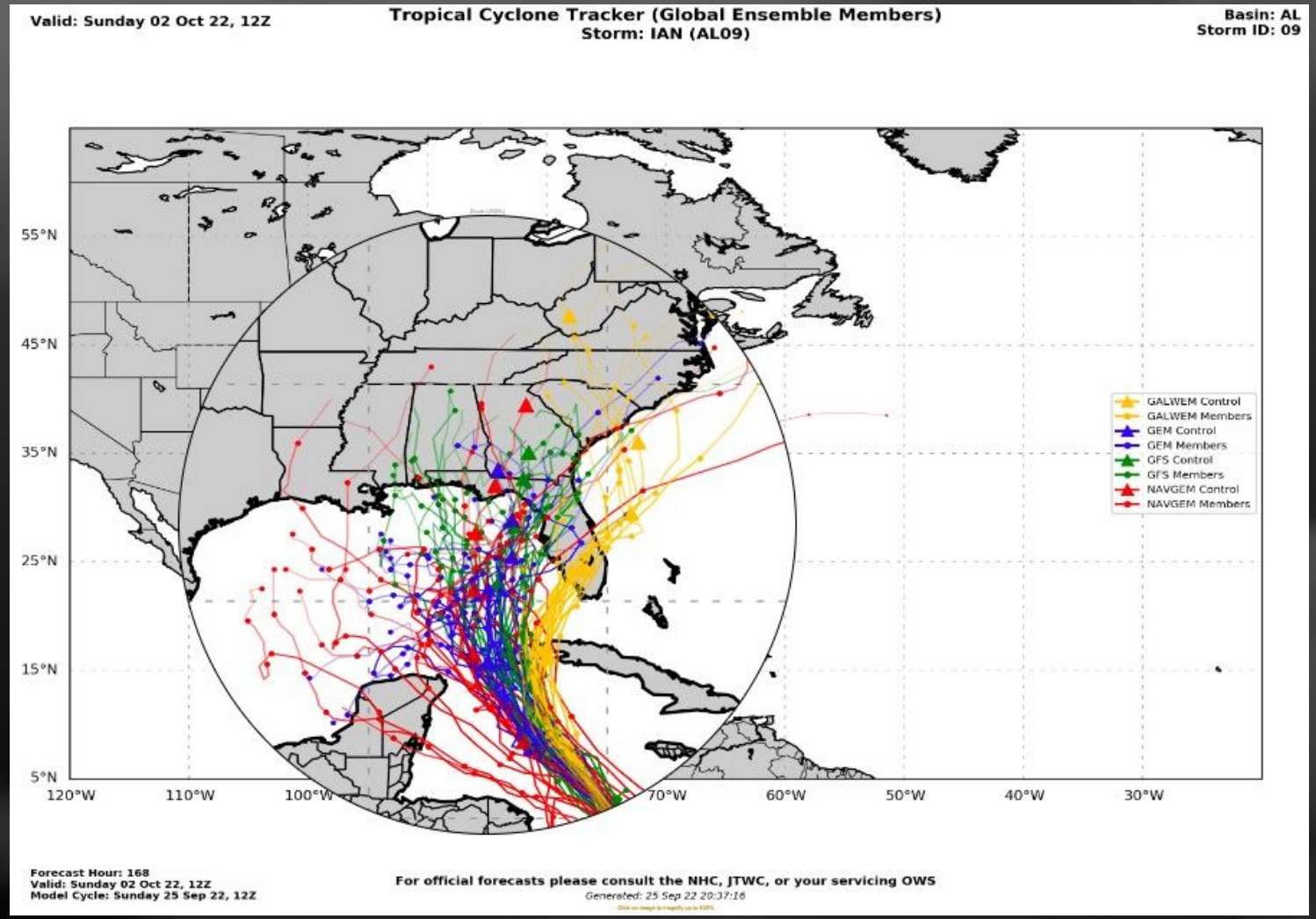
AFWEPS

Air Force Weather Ensemble Prediction Suite

- 2X/day half-degree global 63-member ensemble to 384 hours (GEPS)
  - 21 members each from NOAA, CMC, FNMOC
- 12X/day WRF 16-member regional ensembles (MEPS)
  - 20 km to 132 hours, 4 km to 72 hours, 1 km to 30 hours
  - Single runs every two hours, time-lagged 30 hours
  - Each member has unique physics/global background combinations
- Inline diagnostics to calculate algorithms for rapidly changing variables at every model time step
- Regional ensemble domains can be rapidly moved to new areas as decision needs arise



Tropical



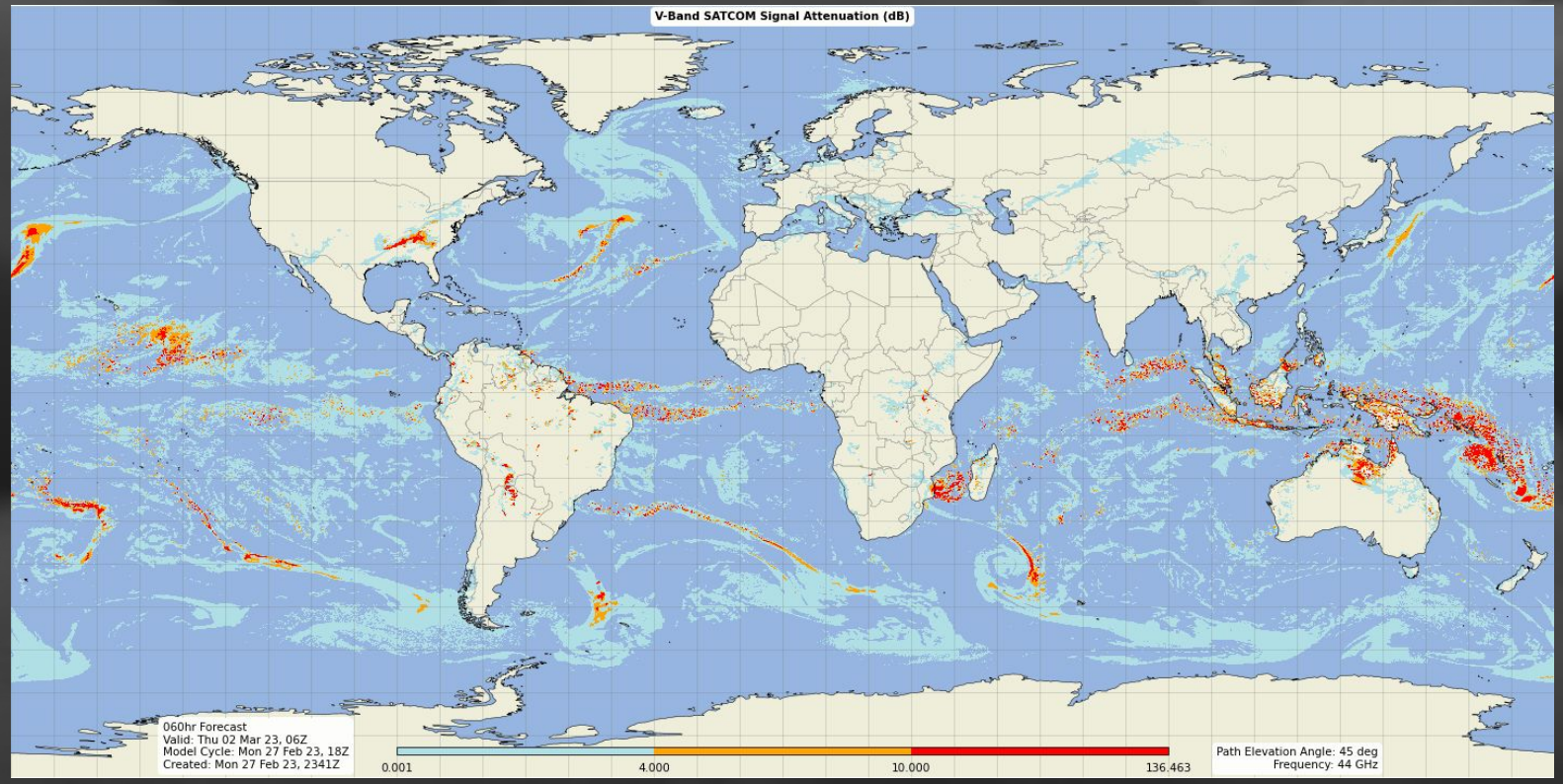
Tropical Cyclone Tracker

- 84-member tropical cyclone track forecasts to 384 hours
- Color-coded by parent ensemble
- Looper and zoom features allow detailed interrogation of forecasts through time

SATSEAM

SATcom Shf/Ehf Attenuation Model

- GALWEM-based deterministic signal attenuation forecasts to 120 hours
- Five frequencies (8, 14, 20, 30, 44 GHz)
- Three look-angles (90, 45, 30 degrees)



Future

- Rapid refresh modeling
  - Grow OCONUS data assimilation capabilities
  - Merge ADVCLD, DCF, and AFWEPS into one streamlined capability
- On-demand modeling in the cloud
  - Enable more sophisticated model setups as warranted
  - Higher enclave capabilities