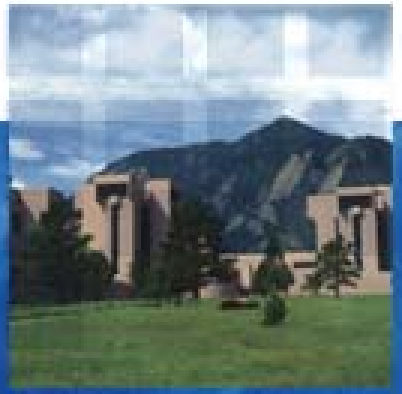
Global/Oceanic Convection Diagnosis and Nowcasting



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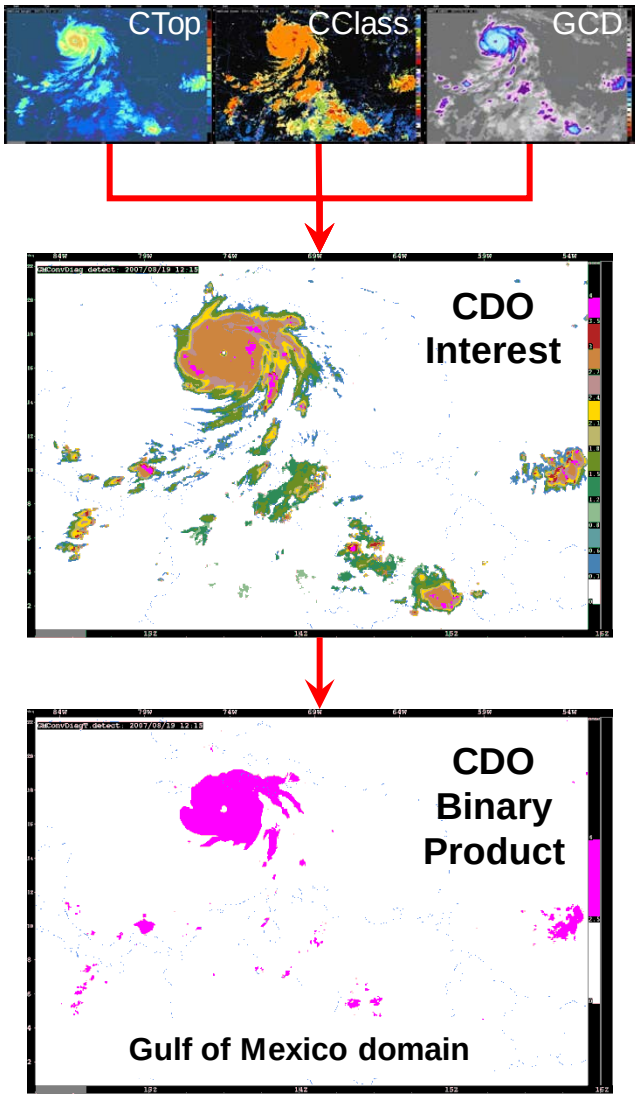
Next Generation Requirements and Gap Analysis

- FAA Next Gen requirements for Global Airspace:
  - Identification and forecasting of deep convection occurrence and intensity
  - Identification and forecasting of turbulence occurrence and intensity
  - In-flight display of weather hazards
- Gaps in current observations for Global Airspace:
  - Low resolution spatial and temporal observations limit product accuracy
  - Low resolution numerical weather prediction results limit product accuracy
  - Real time access to global satellite data sets can be difficult
  - Non-uniform full disk scans (temporal/spatial/data collected) impede merging of data sets
  - Polar orbiter data latency negates real time use
  - Communication with transoceanic aircraft limited in band width and fidelity
- Gaps in current research for Global Airspace:
  - Seamless forecasts of convection between CONUS and Global domains
  - Blending convection extrapolation forecasts with NWP forecasts
  - Convection initiation nowcasts

Convection Diagnosis Oceanic (CDO) Product



Satellite-based detection of deep convection for remote regions

- Data fusion of 2-3 algorithms creates interest field
  - Cloud top height
  - Cloud classification
  - Global convective diagnosis
- Threshold applied for binary product
- TRMM provides validation (Donovan et al., 2009)

Implemented over regional and global domains

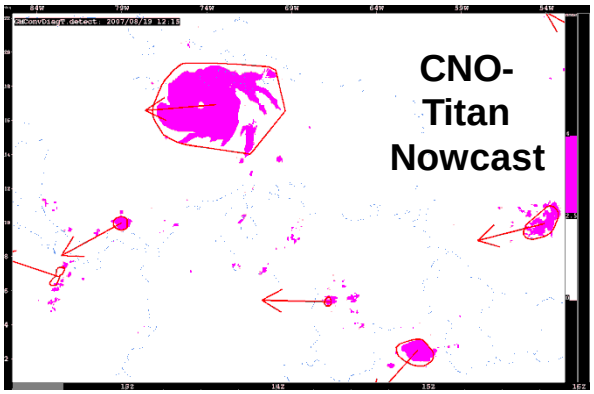
Category	POD	FAR	Bias	CSI
All	**0.72**	**0.26**	**0.98**	**0.58**
Day	**0.82**	**0.26**	**1.10**	**0.64**
Night	**0.47**	**0.28**	**0.66**	**0.40**
Ocean	**0.70**	**0.26**	**0.94**	**0.56**
Land	**0.74**	**0.26**	**1.01**	**0.59**

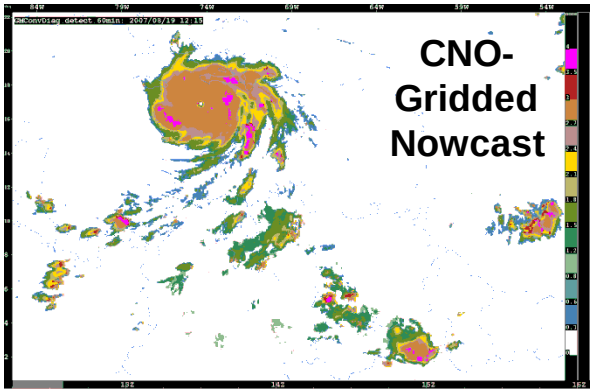
Manual TRMM Validation of CDO

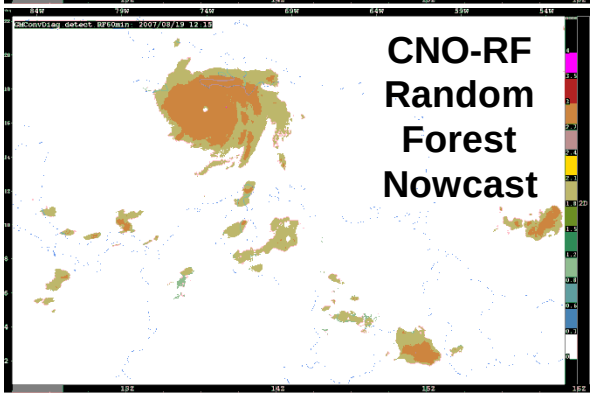
1817 cells analyzed

12-22 Aug 2007 Hurricane Dean

Convection Nowcasting Oceanic (CNO) Product







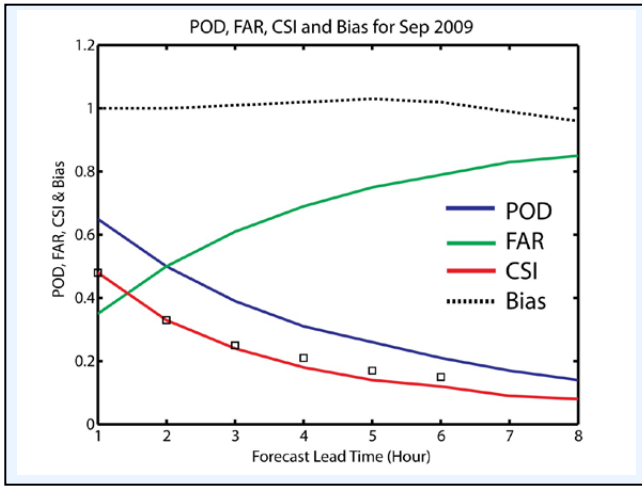
Using CDO, nowcast location of deep convection.

Three extrapolation methods tested (Cai et al. 2010)

- TITAN (object tracking to 8hr, growth/decay)
- Gridded Forecast (gridded nowcasts to 8hr, no growth/decay)
- Random Forest (statistical technique to 3hr, with growth/decay)

Gridded Forecast is best overall method

– Implemented in regional and global domains

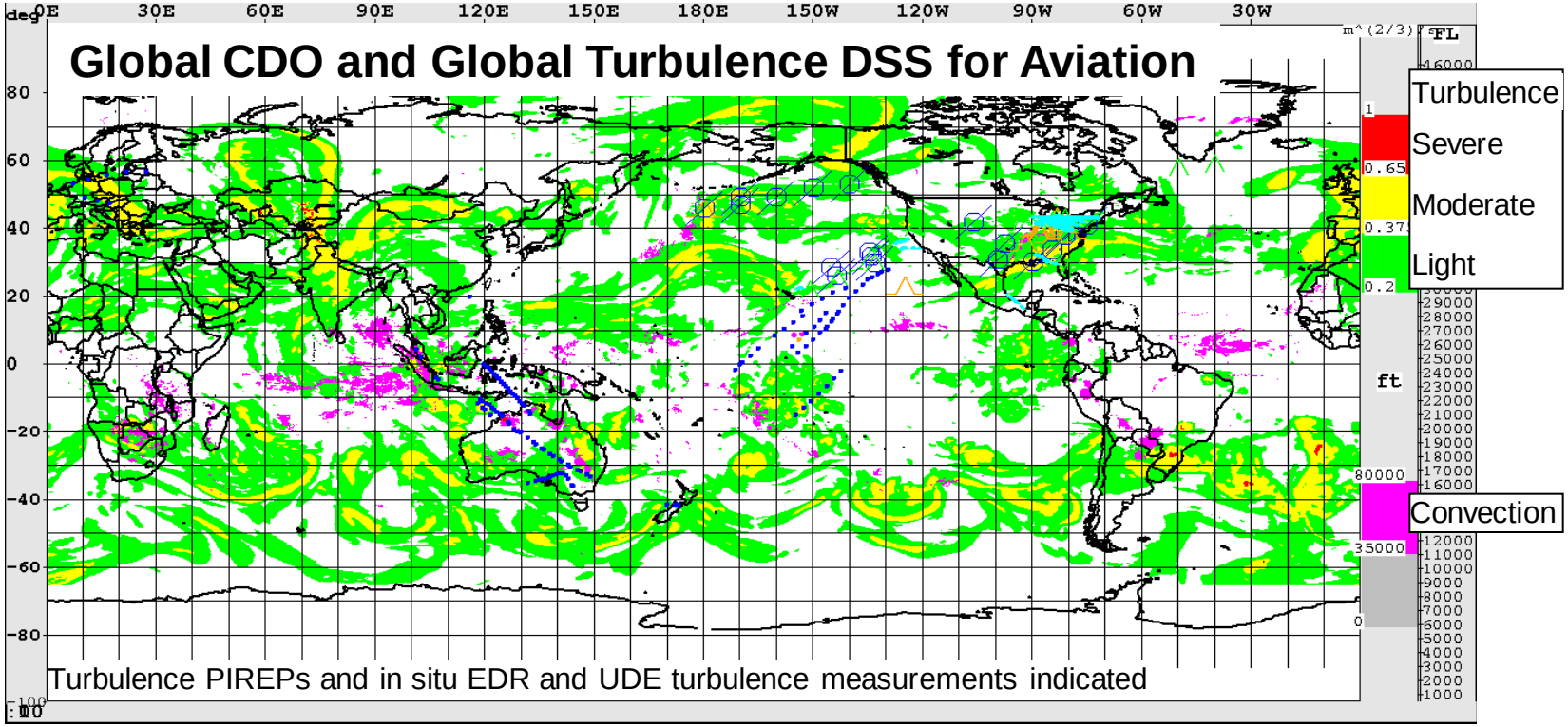


CNO-Gridded validation of 1-8 hr nowcasts

Storms from Sep 1-30, 2009 used, within Gulf of Mexico domain

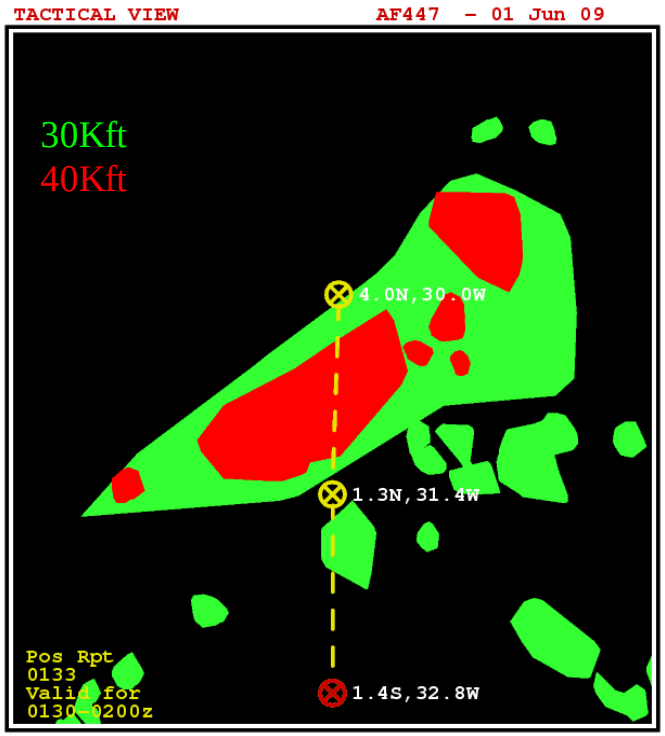
Global Convection and Global Turbulence

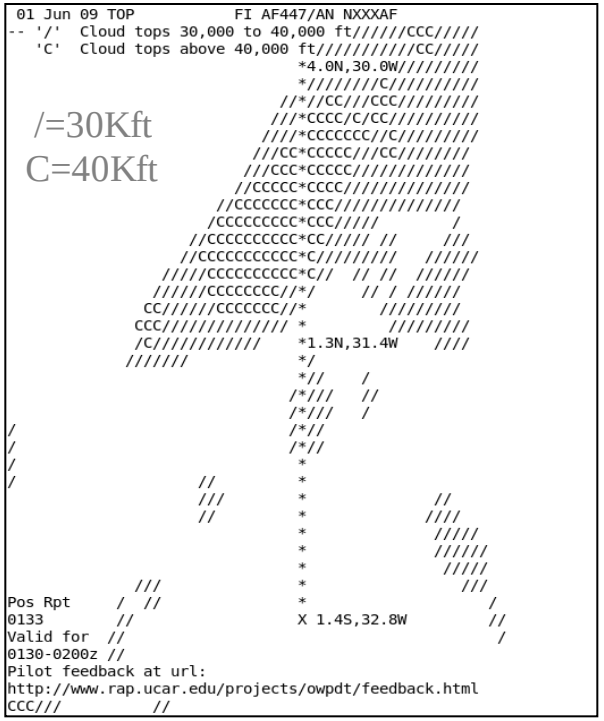
- Expand CDO/CNO to global domain for convection
- Create Global CDO/CNO for inclusion in the Global Turbulence DSS for Aviation as an indicator for convectively-induced turbulence
  - CDO simplified to use cloud top height and global convective diagnosis
  - CNO uses the gridded nowcast technique to 8 hours



Weather Technology in the Cockpit

- In-flight display of weather hazards, including deep convection and turbulence
  - Cloud top height shown below





Simulated uplink displays of GOES-E cloud top heights from 1 June 2009 at 0115 UTC relative to last pilot contact from Air France Flight 447 (bottom center ⊗ or X)