

Probabilistic Convective Storm Guidance for Strategic Planning of Offshore and Transoceanic Flights

Huaqing Cai, Matthias Steiner, Joe Grim, Tina Kalb, Cathy Kessinger, James Pinto, and Ken Stone
National Center for Atmospheric Research (NCAR) Research Applications Laboratory (RAL), Boulder, Colorado



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Matt Strahan

Contact: msteiner@ucar.edu

NOAA/NWS Aviation Weather Center (AWC), Kansas City, Missouri



Motivation & Goals

Opportunities for Improvement

- Weather guidance needed with better spatial and temporal resolution than current operational oceanic convective products (e.g., SIGMET & SIGWX charts)
- Include characterization of forecast uncertainty (not explicitly available in current WAFC products)

Prototype Development

System Approach

- Harvest global ensemble forecasts to generate probabilistic convection hazard guidance
- Design that enables expansion to include multiple NWP centers for global harmonization
- Collaboration with end users (WAFC, airline dispatch)

Assessment

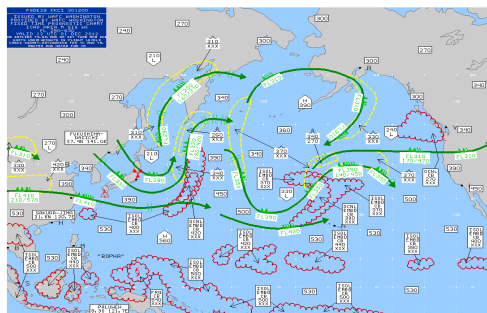
Assessment Approach

- Develop appropriate convection hazard truth field with limited observations over oceanic airspace
- Initial assessment based on qualified CMORPH (e.g., masked with cloud top height, CAPE)
- Consider variation of truth field characteristics across geographical domains & seasons

December 1, 2012 – Sample Case 24 hour Forecast

Current WAFC Products

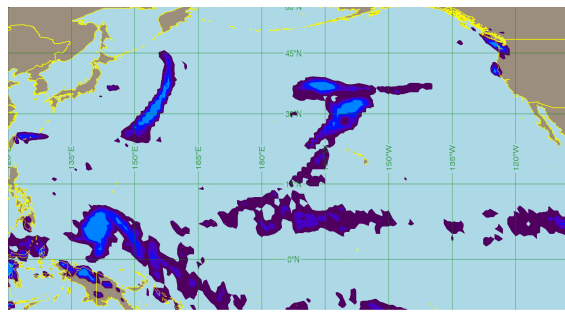
Two World Area Forecast Centers (London & Washington) provide meteorological information



WAFC product valid for 12-01-2012 12Z. Red contours indicate areas of expected storms

Probabilistic Forecast Guidance

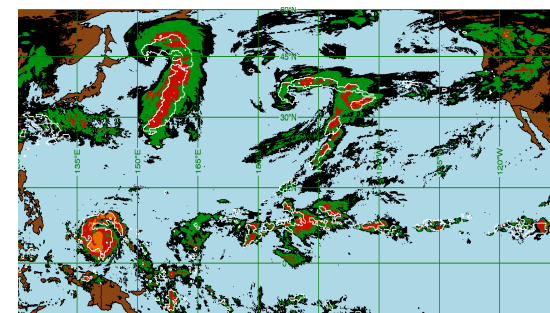
Ensemble-based convection likelihood guidance product with minimally 24 hour outlook



Prototype guidance valid 12-01-2012 12Z

Observed Conditions

Merged satellite cloud top heights (colors) & CMORPH >1mm/h (white contours)



Goals

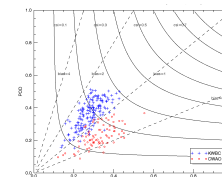
- Develop probabilistic forecasting capability for strategic planning of transoceanic flights
- Utilize available global ensemble forecasts to generate calibrated convection likelihood product with 24-hour to 36-hour outlook
- Improve the prediction & verification capabilities of convective weather over oceans

Super-Ensemble Model Synthesis

- Leveraging multiple NWP centers
- Scalable technique to include additional ensemble forecasts
- Initial prototype based on CWAQ, KWBC & EGRR

Center	ID	Members	Runs [UTC]
European Centre for Medium-Range Weather Forecasts (ECMWF)	ECMF	51	00, 12
United Kingdom MetOffice	EGRR	24	00, 12
Météo-France	LFPW	35	06, 18
Meteorological Service of Canada (MSC)	CWAQ	21	00, 12
United States National Centers for Environmental Prediction (NCEP)	KWBC	21	00, 06, 12, 18
Brazilian Centro de Previsão de Tempo e Estudos Climáticos (CPTEC)	SBSJ	15	00, 12
Centre for Australian Weather and Climate Research (CAWCR)	AMMC	33	00, 12
Chinese Meteorological Administration (CMA)	BABJ	15	00, 12
Japan Meteorological Agency (JMA)	RJTD	51	12
Korean Meteorological Administration (KMA)	RKSL	24	00, 12

Example Verification



- Grid-point statistics computed for 24-hour forecast, Nov 15 – Dec 23: KWBC (blue) & CWAQ (red)
- Thresholded forecasts at $P > 45\%$
- CMORPH > 1 mm/h used as "proxy" truth

Relevant References

- Bougeault, P., et al., 2010: The THORPEX Interactive Grand Global Ensemble (TIGGE). *Bull. Amer. Meteor. Soc.*, **91**, 1059 – 1072.
- Joyce, R. J., et al., 2004: CMORPH: A method that produces global precipitation estimates from passive microwave and infrared data at high spatial and temporal resolution. *J. Hydrometeorol.*, **5**, 487 – 503.
- Roebber, P., 2009: Visualizing multiple measures of forecast quality. *Wea. Forecasting*, **24**, 601 – 608.



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