144: Initial Validation of the New ECMWF Cubic Octahedral Nature Run (ECO1280)

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1. Abstract

The new ECMWF Cubic Octahedral (O1280) grid Nature Run (ECO1280) has been generated with the March-November 2016 operational configuration of the Integrated Forecasting System (IFS), (IFS cycle 43r1). This configuration has T1279 spectral resolution, 9-km horizontal resolution, and 137 vertical levels. The ECO1280 extends for 14-months from a starting date of 30 September 2015. This initialization date for was chosen to coincide with the intensification of Hurricane Joaquin, guaranteeing that Joaquin would be captured in the ECO1280 to support its validation. Initial validation of ECO1280 for Hurricane Joaquin is presented. Results comparing the NR with both satellite (not shown) and dropsonde observations of Hurricane Joaquin show that the ECO1280 reasonably captures the structure of the cyclone. Additionally, track and intensity are shown to be reasonable when compared to the 'best track' information archived on the NOAA National Hurricane Center's online repository of Tropical Cyclone Reports.

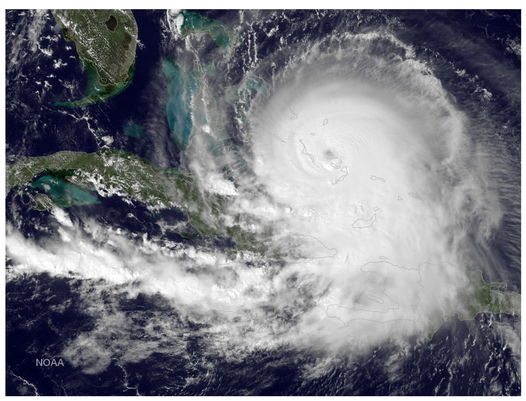
2. Use and Access

The ECO1280 may be used for any research purpose. Interested researchers should acquire the ECO1280 by contacting CIRA/CSU to describe planned usage and to obtain data access instructions. Resulting publications or presentations must acknowledge ECMWF and CIRA/CSU. For details, consult the ECO1280 website (https://www.cira.colostate.edu/imagery-data/ecmwf-nature-run/).

3. Motivation

- The ECO1280 NR is being produced from the ECMWV IFS operational forecast model.
- This has the advantage that it has be completely and thoroughly validated for
  a) short- and medium-range forecasts
  b) sub-seasonal, seasonal, and annual time scales but at a lower resolution using the seasonal forecast system.
- For further details about the ECO1280 dataset see Dr. Ross Hoffman's presentation on Tuesday, Jan. 8, at 8:30 am (4.1).

4. Hurricane Joaquin (AL112015)



1. Category 4 hurricane with strong wind and storm surge.
2. Strongest October hurricane to affect the Bahamas since 1866.
3. 34 fatalities and $200 million in damage.
4. Strongest hurricane of non-tropical origin (satellite era).

5. Track and Intensity Error

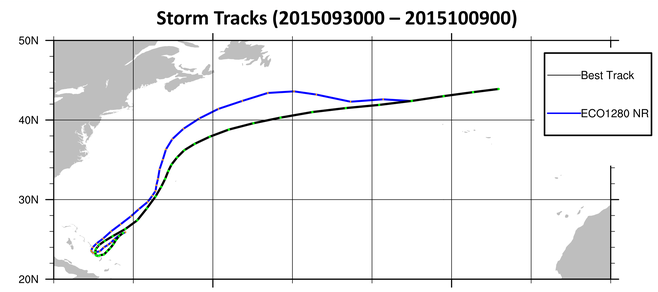


Figure 1: Storm tracks for the ECO1280 NR hurricane (blue line) and for Hurricane Joaquin (black line). Overlaid dots represent the position of the storm every 6 hours.

- The ECO1280 NR captures the track of Hurricane Joaquin well for the first three days (i.e., 9/30 to ~10/3), with track error averaging around 50-km. After 3 Oct. track error increases, as shown by the large northward deviation in the blue line in Figure 1.
- The ECO1280 NR hurricane is first faster than the real storm and then begins to slow down between 3 October and 4 October.
- The ECO1280 NR hurricane captures the rapid intensification of Hurricane Joaquin when looking at sea-level pressure (Figure 2a).
- This is not captured in the maximum wind speed (Figure 2b) and is a known aspect of the ECMWF operational model.
- Large differences could be due to limitations of model resolution.

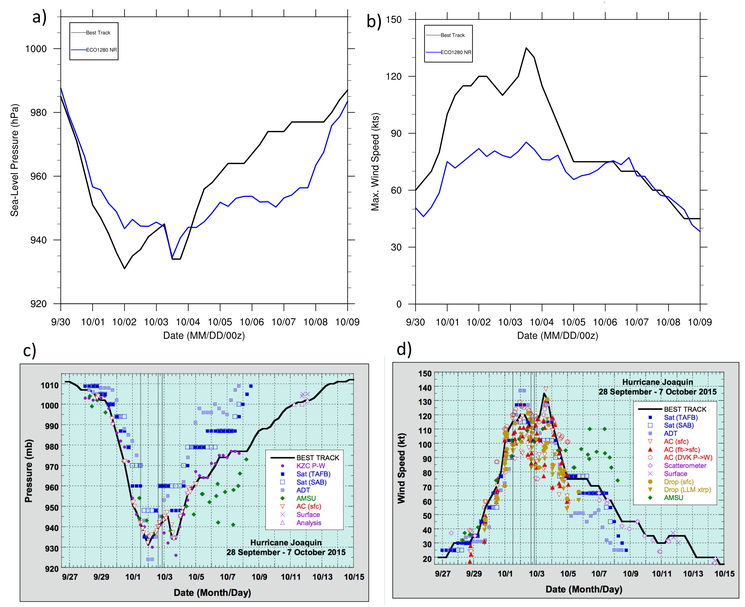


Figure 2: Storm intensity for the ECO1280 NR hurricane (upper row: blue line) and Hurricane Joaquin (upper row: black line). Plot of storm intensity for Hurricane Joaquin obtained from NOAA National Hurricane Center's online repository.

6. Comparison with NOAA Dropsonde profiles

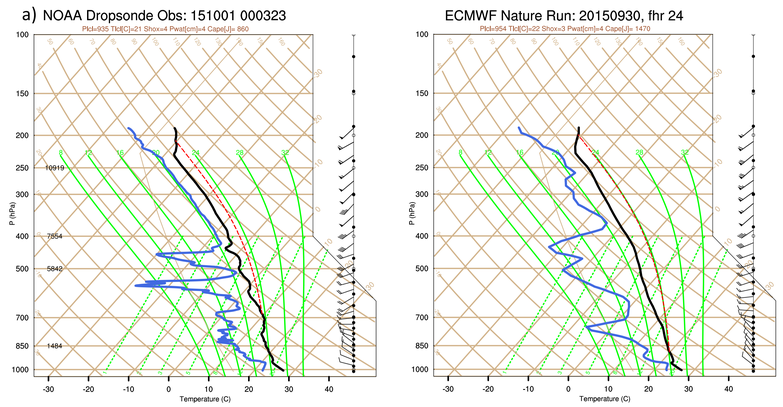
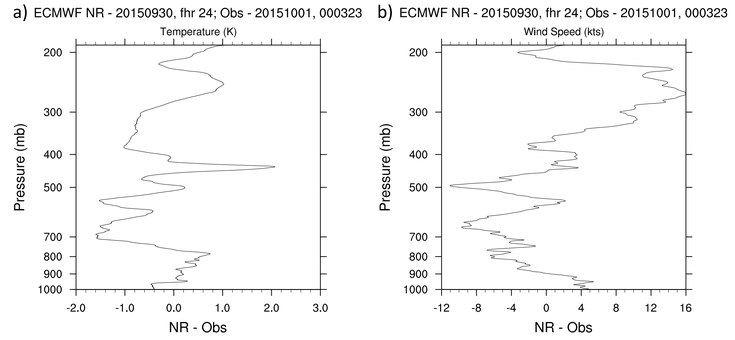


Figure 3: SkewT diagrams showing temperature (black) and dewpoint temperature (blue) valid at 2015100100 generated using data from a) dropsondes released during NOAA G-IV aircraft missions into Hurricane Joaquin and b) the ECO1280 NR linearly interpolated to the 'storm relative' location (lat-lon-lev) of the NOAA dropsonde. Note that titles show a) the valid time (2015100100) of the b) 24 hour forecast from 20150930.

Figure 4: Difference in vertical profiles between the ECO1280 NR and dropsonde a) temperature and b) wind speed observations at a valid time of 2015100100 (or forecast hour 24 initialized from 2015093000).



Dropsonde data for Hurricane Joaquin was obtained from the following website: http://www.aoml.noaa.gov/hrd/Storm_pages/joaquin2015/

- The ECO1280 NR captures the general structure of the vertical temperature and dewpoint temperature profile found with the NOAA G-IV dropsonde instrument (Figure 3). Though only one time step is shown, this tendency is seen for all available timesteps (up to fhr 45).
- Differences between the ECO1280 NR vertical profile and that measured by the dropsonde shows values that fluctuate around zero one day into the NR (Figure 4). This is also the case for other forecast hours (fhrs: 18, 21, 24, 30, 33, 36, 42, and 45). This highlights that there is no relative bias in the ECO1280 NR during this time period and that it reasonably captures the vertical structure of Hurricane Joaquin.

7. Summary and Acknowledgments

Summary

Comparisons between the ECO1280 NR and 'best track' data from NHC show small errors in track and intensity for the first 36 to 48 hours. Additionally, the ECO1280 NR hurricane captures the rapid intensification of Hurricane Joaquin.

Comparisons between the ECO1280 NR and dropsonde data from NOAA's G-IV show that the NR reasonably captures the vertical structure of Hurricane Joaquin within the first 48 hours. Additionally, all differences are centered on zero, highlighting that there is no bias in the NR when compared to the dropsonde observations.

Acknowledgements

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