Improvement to the Tropical Cyclone Genesis Index (TCGI)

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Discussion Outline

Motivation

- Enhance the Tropical Cyclone Genesis Index (TCGI), a real-time, <u>objective</u>, <u>disturbance-centric</u> scheme for identifying the probability of TC genesis in the NATL

Tropical Cyclone Genesis Index (TCGI)

- Background & overview
- TCGI enhancements
- 2011-2016 verification

Conclusions & Future Work

TC Genesis Index (TCGI)
*Objective/disturbance centric/probabilistic scheme
for predicting TC genesis (0-48 hr & 0-120 hr)*
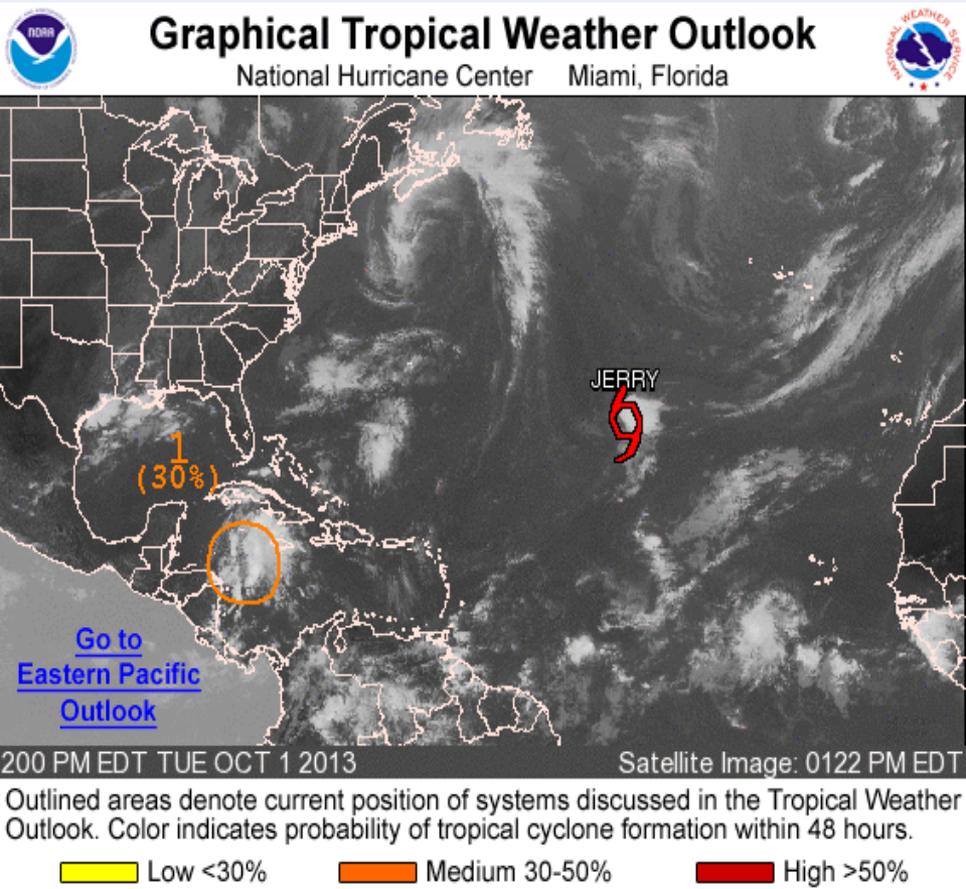
- Transitoned operations at NOAA NHC (fall 2014)

- Runs on NATL invests identified by NHC

- Requires TAFB Dvorak fixes (F-Deck)

- Run times: 00/06/12/18 UTC
  t=-2 hr: :30 & :45
  t=-1 hr: :00/:15/:30/:45/:55

TC Genesis Index (TCGI)

Year-2 Work Plan: **Completed** -- **In Progress** -- **Not Begun**

Fall 2016

- Develop Complete identification/development of new NATL/EPAC-CPAC TCGI predictors
  - ➢ e.g. WWLN lightning, moisture/VWS parameters, satellite TOTs

Dec 2016

- Develop code for running a real-time version of the NATL & EPAC-CPAC TCGI (GFS version)

March 2017

- Present year-2 results at IHC

TC Genesis Index (TCGI)

Year-2 Work Plan: **Completed** -- **In Progress** -- **Not Begun**

<u>May-Aug 2017</u>
- Perform real-time tests of 0-48 and 0-120 h NATL & EPAC-CPAC TCGI (GFS version) on NESDIS computers at CIRA

<u>May-Aug 2017</u>
- Finish development/evaluation of prototype ECMWF-based TCGI for the North Atlantic

<u>Aug 2017</u>
- Final code for running both the NATL & EPAC-CPAC TCGI on operational NCEP computers will be provided to NHC/NCEP IT personnel if the project is accepted for operational transition

TC Genesis Index (TCGI)
Enhancements

1) Expanded TCGI database to include 2001-2014
  - *currently 2001-2010*

2) Expanded TCGI to include EPAC-CPAC basins
  - *New NATL & EPAC-CPAC TCGI installed on WCOS (testing)*

3) Developing an ECMWF-based TCGI (North Atlantic)
  - *New ECMWF TCGI installed on WCOS (testing)*

4) Setting up a mechanism for more timely F-Deck access
  - *invest fix information direct from NOAA TAFB*

5) Added 850 relative vorticity (GFS)
  - *replaces GFS 850 hPa vortex tendency (DV24)*

TC Genesis Index (TCGI)
Enhancements (Cont'd)

6) Added 925-1000 relative humidity (GFS)
- *replaces GFS 600 hPa relative humidity (MLRH)*

7) Testing reduced 0-48 hr predictor search (R=200/300/400 km)
- *currently R=500 km for 0-48 hr and 0-120 hr*
- *Tested R200 (degraded 2013-2015 forecasts)*
- *testing R300/R400/R500 km*

Pre-Hurricane Matthew Invest
- 26 Sep 2015 1145 UTC
- ~48 hr before genesis
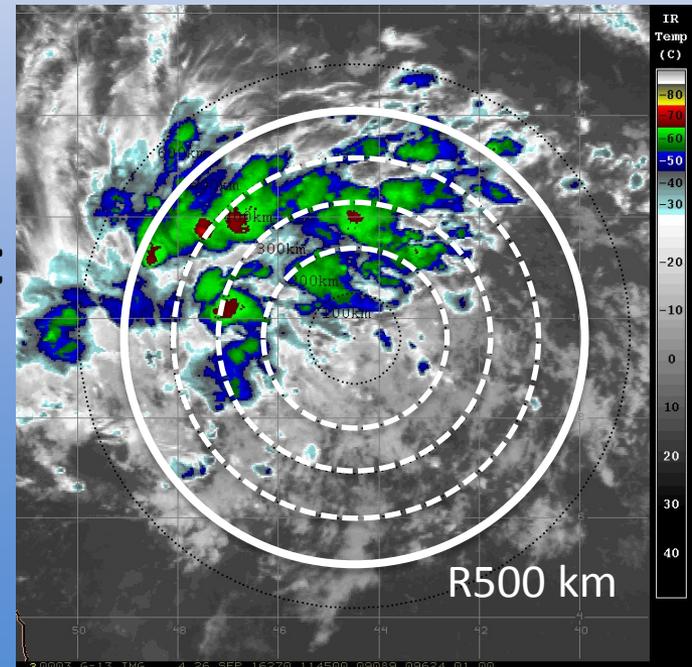
TC Genesis Index (TCGI)
Relative Predictor Weights (2001-2014 Invest Database)
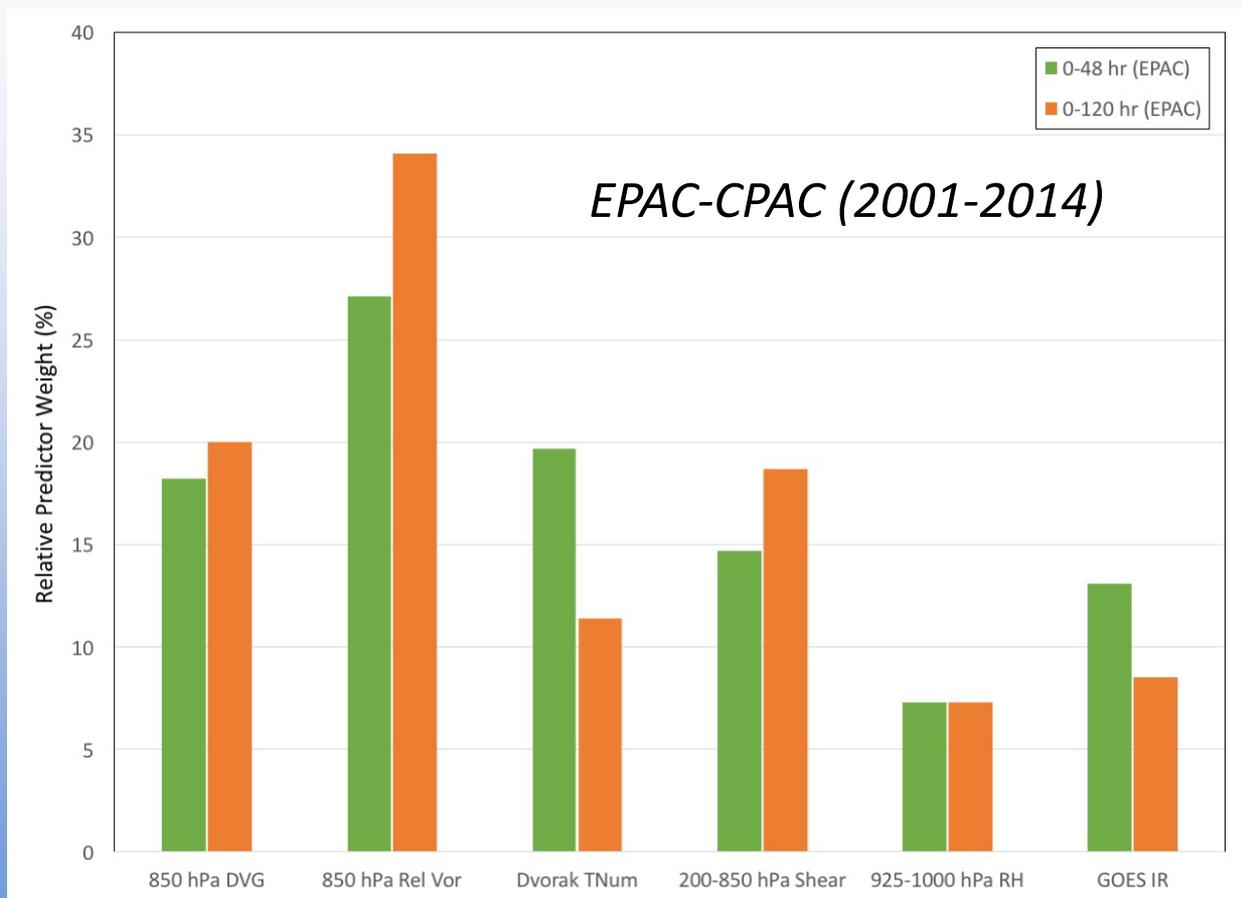
850 hPa **horizontal divergence** (GFS)

850 hPa **relative vorticity** (GFS)

NOAA TAFB **Dvorak T-number**

200-850 hPa **vertical wind shear** (GFS)

925-1000 hPa **RH** (GFS)

% **GOES water vapor** pixels <-40 C

TC Genesis Index (TCGI)
Brier Skill Score
2001-2014 (cross validated)

North Atlantic (2001-2014)
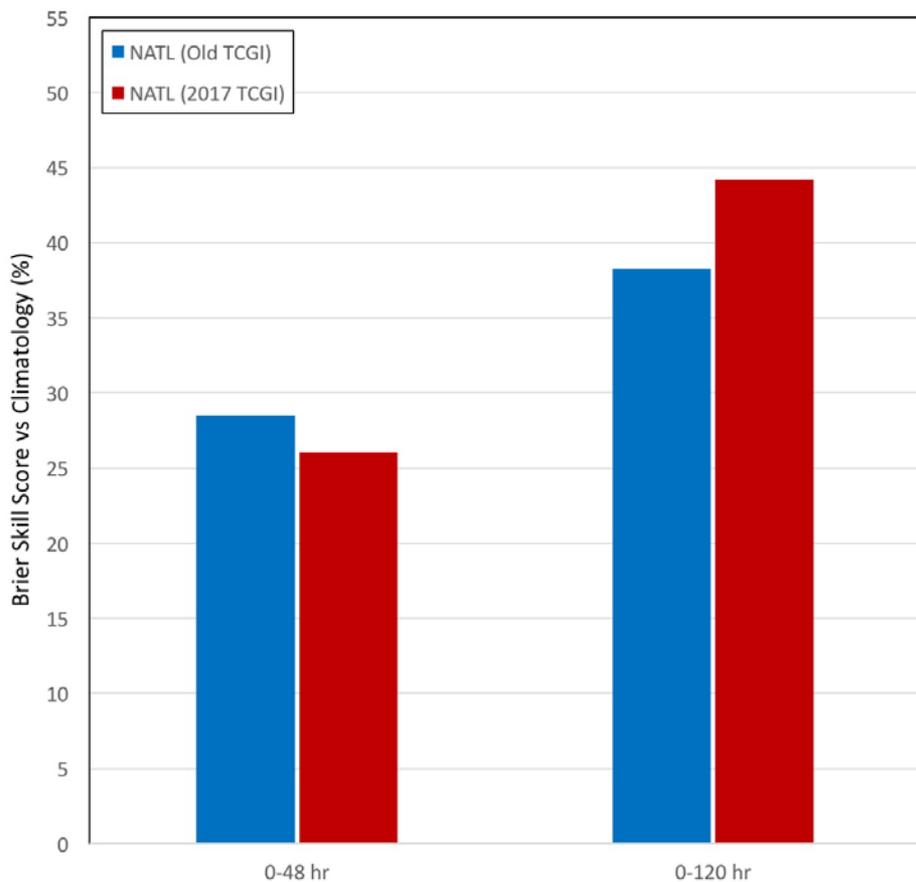
EPAC-CPAC (2001-2014)
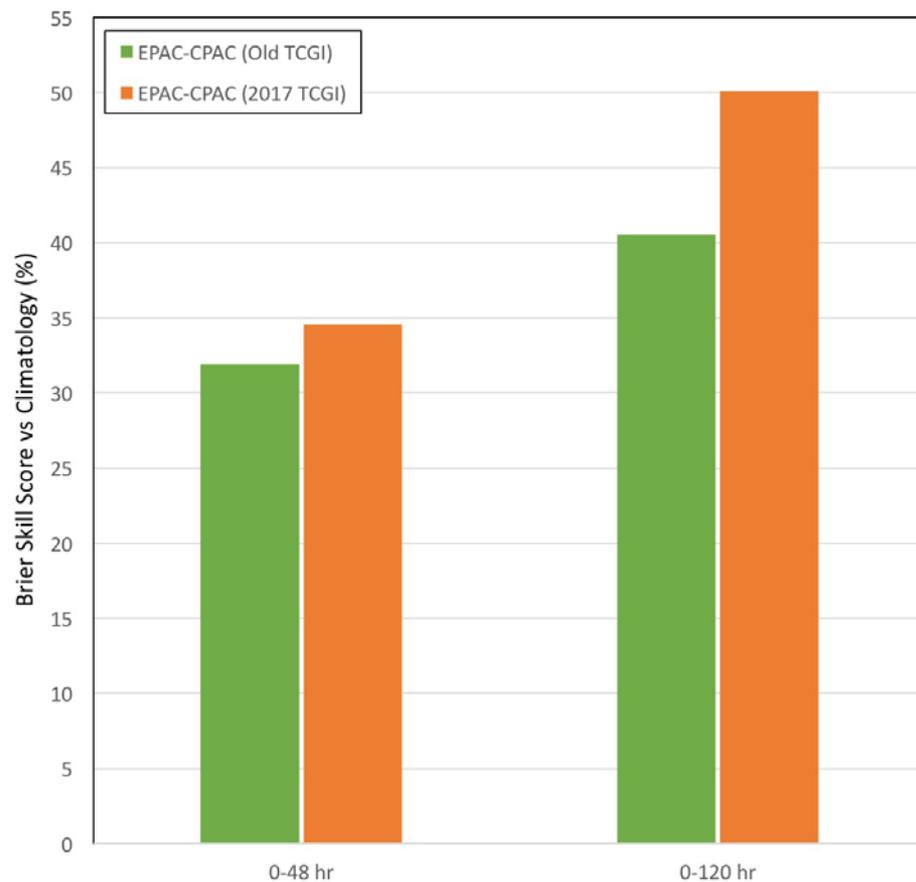
TCGI Forecast Verification
0-48 hr: 2011-2016
0-120 hr: 2013-2016

TC Genesis Index (TCGI)
Reliability Diagram (2011-2016)
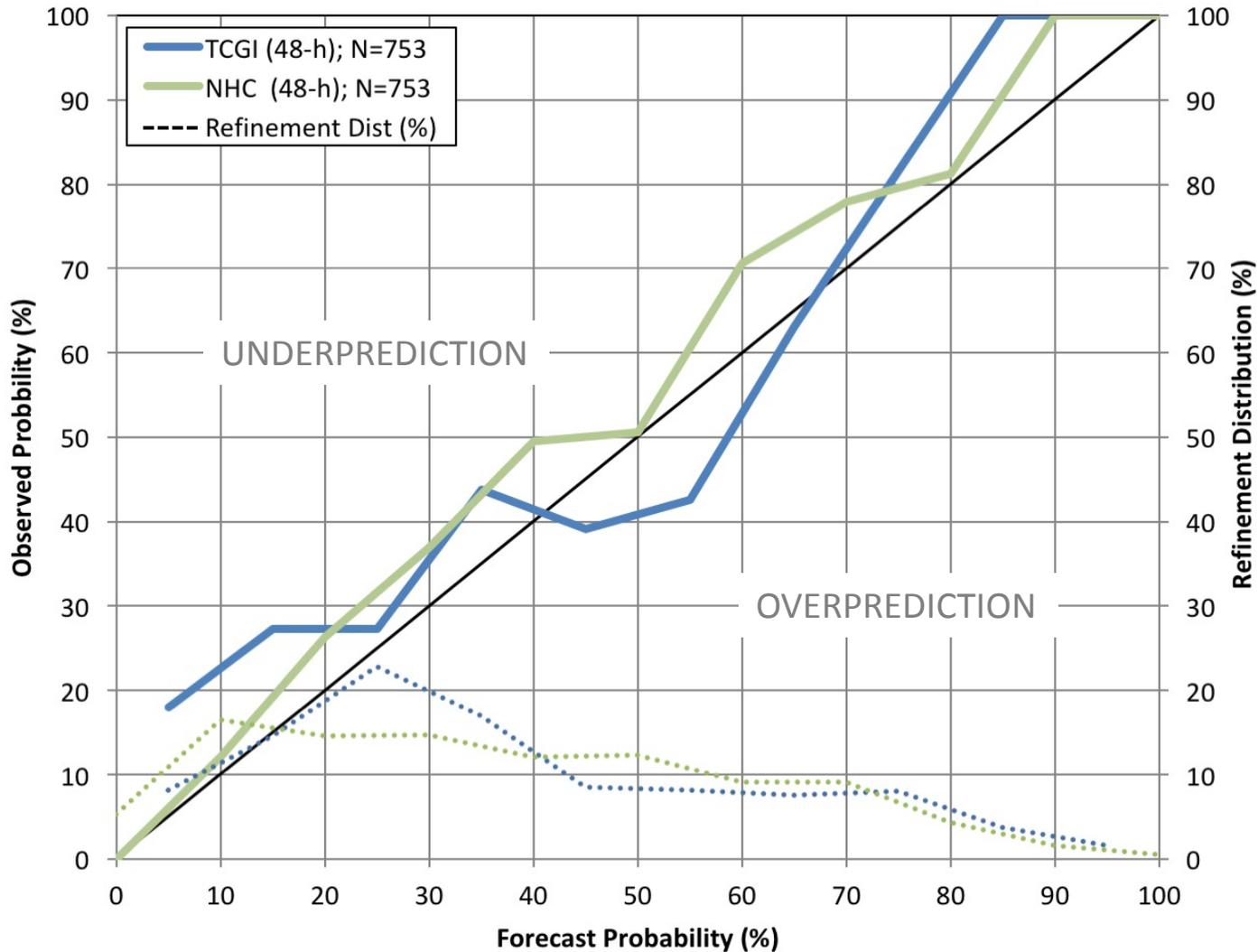
TC Genesis Index (TCGI)
Reliability Diagram (2013-2016)
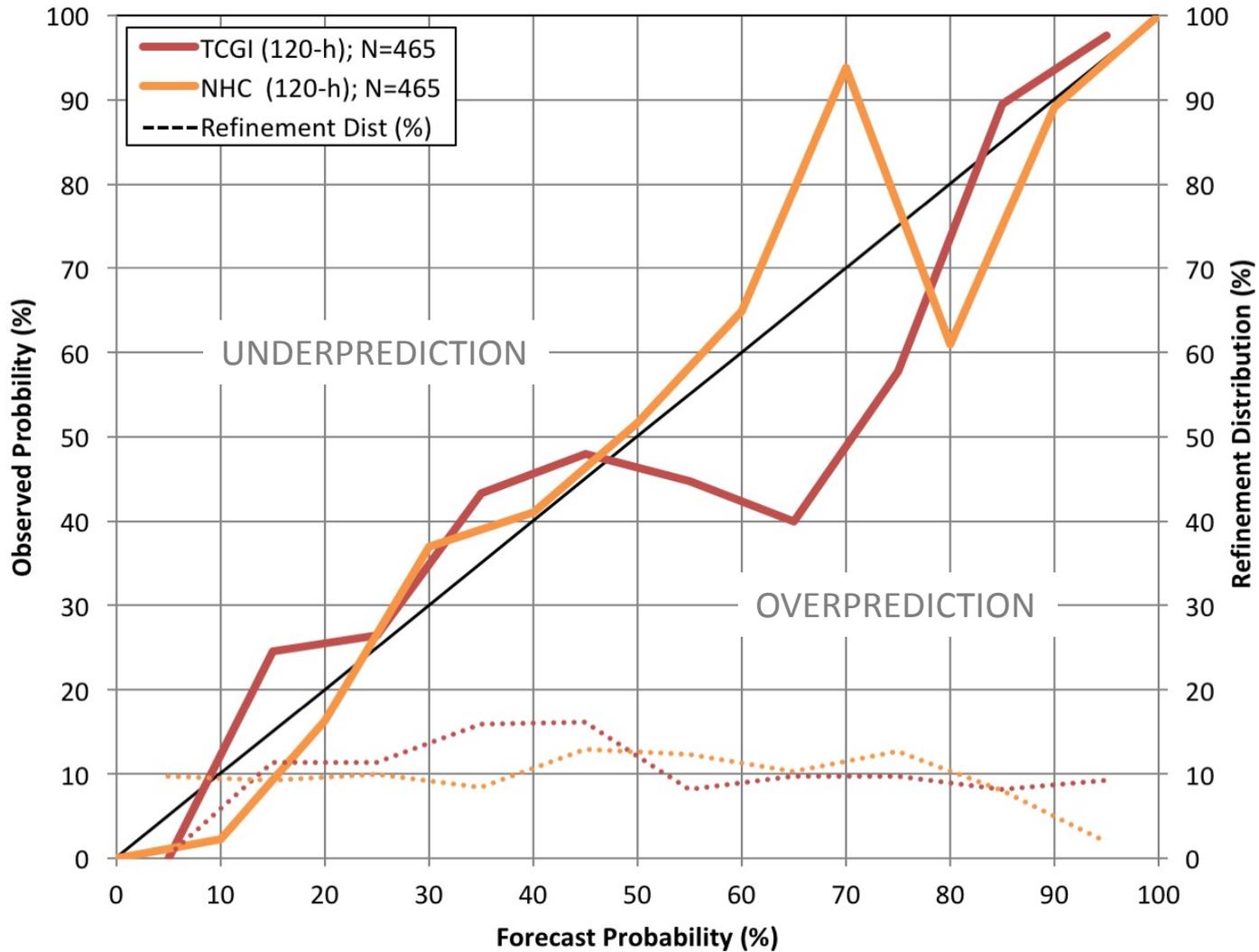
TC Genesis Index (TCGI) vs NHC TWO
Brier Skill Score
0-48 hr (2011-2016); 0-120 hr (2013-2016)
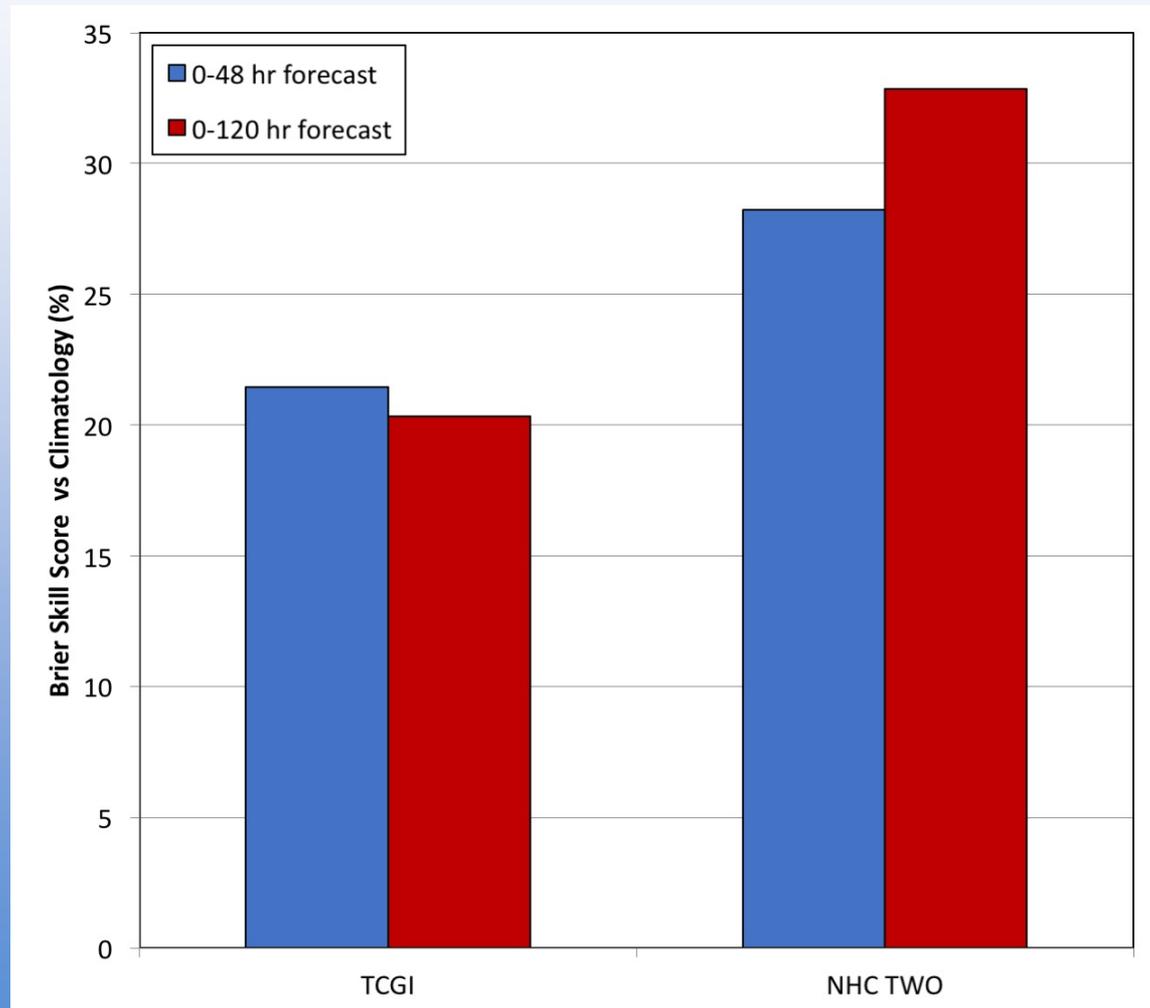
Conclusions & Future Work

TCGI Year-1 & -2 Efforts (Completed)
- Expanded TCGI database (2001-2014)
- Expanded TCGI to EPAC-CPAC
- Developed new TCGI predictors (NATL/EPAC-CPAC)

TCGI Year-2 Efforts (In Progress/Planned)
- ECMWF-based TCGI (NATL) >> WCOSS testing
- Real-time GFS versions of TCGI (NATL & EPAC-CPAC) >> WCOSS testing
- Reduced 0-48 hr predictor search area (R200/300/400 km)
- Mechanism for more timely F-Deck access
- On track to deliver final TCGI code to NHC (Aug 2017)

Real-Time 2017 TCGI Runs

http://rammb.cira.colostate.edu/projects/tc_genesis/
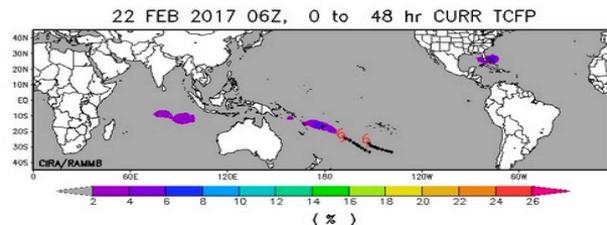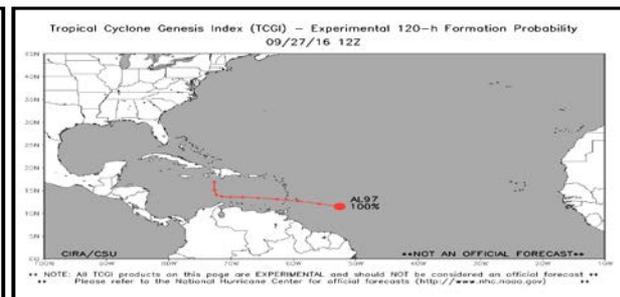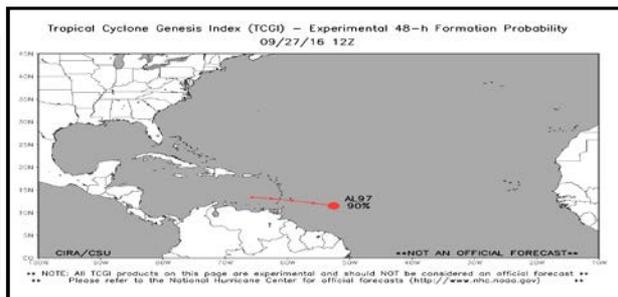
Questions

TCGI Forecast Verification
2016

TC Genesis Index (TCGI)
Reliability Diagram (2016)

TC Genesis Index (TCGI)
Reliability Diagram (2016)