The tropical cyclone (TC) genesis index (TCGI) is an operational statistical-dynamical model that predicts the probability of TC genesis for 0-48 hr and 0-120 hr forecasts. To produce these probabilistic forecasts for the Atlantic (AL) and East Pacific (EP) storm basins, the TCGI uses a linear discriminant analysis that is based on six predictors (see Table 1). Of the six predictors, four are taken from the forecast model; the operational version of TCGI uses deterministic forecasts from the Global Forecast System (GFS).

This project extends the deterministic TCGI by using global ensemble forecasts from the Global Ensemble Forecasting System (GEFS, v11). GEFS, v11 is a 21 member system that outputs meteorological fields on a 1x1 degree grid. Ensemble probabilistic TC genesis forecasts are calculated for AL and EP basins during the 2018-2020 seasons. The three-year time period provides ample cases to address several motivating questions:

1. How does verification for the ensemble TCGI compare to the deterministic TCGI?
2. Does the TCGI (deterministic or ensemble) predict better for the AL or EP storm basin?
3. Are there ensemble properties, such as storm track spread or TCGI probability spread, that can improve/degrade ensemble TCGI prediction?

TCGI Predictors

<table>
<thead>
<tr>
<th>Predictors</th>
<th>AL weights (2 day/5 day)</th>
<th>EP weights (2 day/5 day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>850 hPa Divergence</td>
<td>4.02/5.69</td>
<td>3.05/5.58</td>
</tr>
<tr>
<td>850 hPa Vorticity</td>
<td>2.87/6.00</td>
<td>4.45/7.67</td>
</tr>
<tr>
<td>300-850 hPa Vertical Shear</td>
<td>3.13/3.39</td>
<td>2.62/5.05</td>
</tr>
<tr>
<td>600-850 hPa Relative Humidity</td>
<td>-0.03/0.48</td>
<td>1.30/1.10</td>
</tr>
<tr>
<td>G08s Water Vapor Pixels</td>
<td>0.71/1.06</td>
<td>2.52/2.46</td>
</tr>
<tr>
<td>Dvorak T Number</td>
<td>3.25/2.97</td>
<td>3.72/3.32</td>
</tr>
</tbody>
</table>

Table 1. A list of the six TCGI predictors and their normalized weight for each storm basin. The top four predictors are all taken from model forecasts. The bottom two predictors are taken from model forecasts.

Ensemble TCGI Example Cases

Determination vs. Ensemble TCGI

Storm Track Spread

TCGI Ensemble Properties

TCGI Probability Spread

Conclusions

Using TCGI and ensemble forecasts for TC genesis prediction during 2018-2020, we found:

1. Verification of ensemble TCGI is comparable to the deterministic TCGI.
2. Ensemble and deterministic TCGI predict better for the EP storm basin.
3. Ensemble properties can further improve the skill of a forecast compared to the deterministic TCGI in both basins. For example, cases with low spread in storm track improves skill and reliability of the ensemble mean TCGI.

Please see our companion poster:

231: Tropical Cyclone Genesis Index and Global Ensemble Forecasts: Expanding to Global Basin and Evaluation of Real-Time 2021 Forecasts