NOAA Joint Hurricane Testbed (JHT)
Mid-Year Project Progress Report, Year 2

Date:	March 29, 2013
Reporting Period:	August 1 2012 – January 31 2013
Project Title:	Development of a Probabilistic Tropical Cyclone Genesis Prediction Scheme
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Award Period:	August 1, 2011 – July 31, 2013

1. Long-term Objective and Specific Plans to Achieve Them:

The main goal of this project is to develop a disturbance-following tropical cyclone (TC) genesis index (TCGI) to provide forecasters with an objective tool for identifying the 0-48hr and 0-120hr probability of TC genesis in the North Atlantic basin. Predictors from a variety of sources were tested and potentially integrated into this new scheme and included Dvorak T-number / CI value estimates, environmental and convective parameters currently used in the NESDIS TC Formation Probability (TCFP) product (fixed grid scheme), environmental parameters from SHIPS that are relevant to TC genesis, and total precipitable water (TPW) retrievals from microwave satellites. Details about specific efforts that will be taken to achieve this goal can be found in Section 3.

2. Accomplishments:

a. Begin sensitivity testing for optimal combination of TCGI predictors (0-48h and 0-120h).

In year 1, 60 potential TCGI predictors were identified. The methodology used to determine the optimal combination of TCGI predictors was similar to that used to develop the rapid intensity index (RII) by Kaplan et al. (2010). The only predictors selected for optimal testing are those for which it had been shown that statistically significant differences existed at the 99.9% level between the mean values of the genesis and non-genesis samples. Sensitivity tests (including linear discriminant analyses) were conducted to determine which combination of TCGI predictors and predictor weights yielded the most skillful genesis forecasts. Resulting predictor weights and probabilities are shown in Figure 1. The optimized TCGI provides a skillful forecast over the developmental dataset (2001-2010) relative to various reference forecasts (Figure 2).

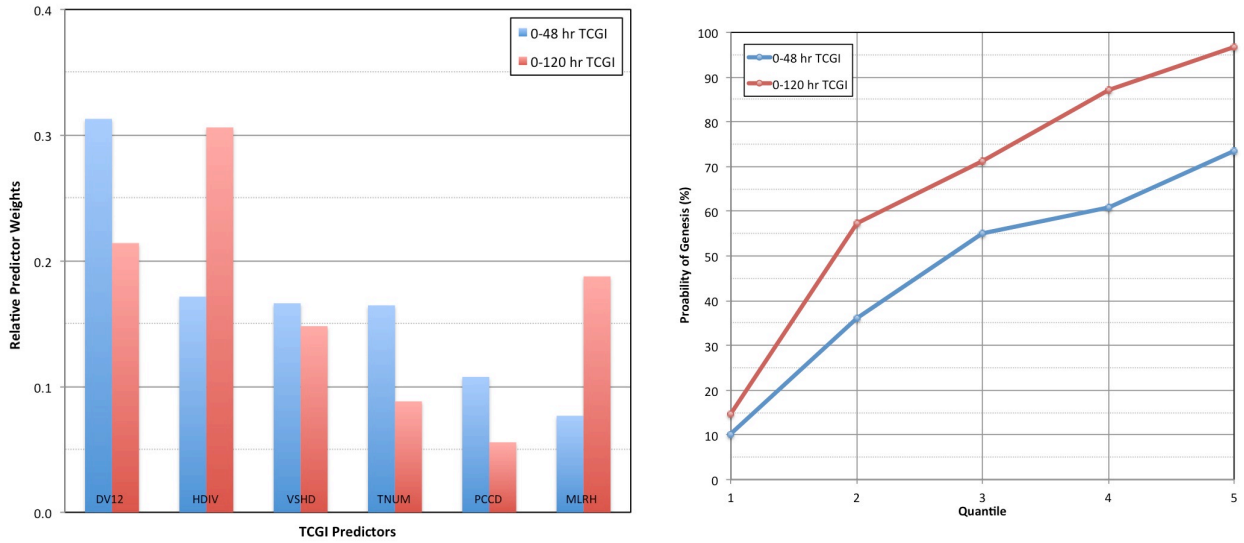


Figure 1. The relative predictor weights (left) for the prototype TCGI and the corresponding genesis occurrence frequency (%) for the five quantiles that were utilized (see Kaplan et al. 2010 for more details). The predictors used in the TCGI are GFS 12-hr vortex tendency (DV12), 850-hPa divergence (HDIV), 850-200 hPa vertical shear (VSHD), Dvorak T-number (TNUM), GOES percent of cold cloud (<-40 C) pixel coverage (PCCD), and GFS 600-hPa relative humidity (MLRH). Note that DV12, HDIV, VSHD, PCCD, and MLRH are averaged over a radius of 500km.

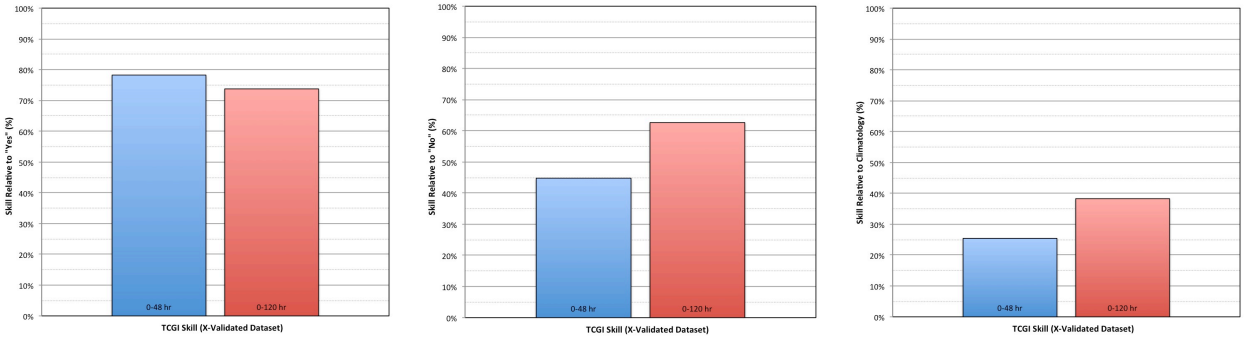
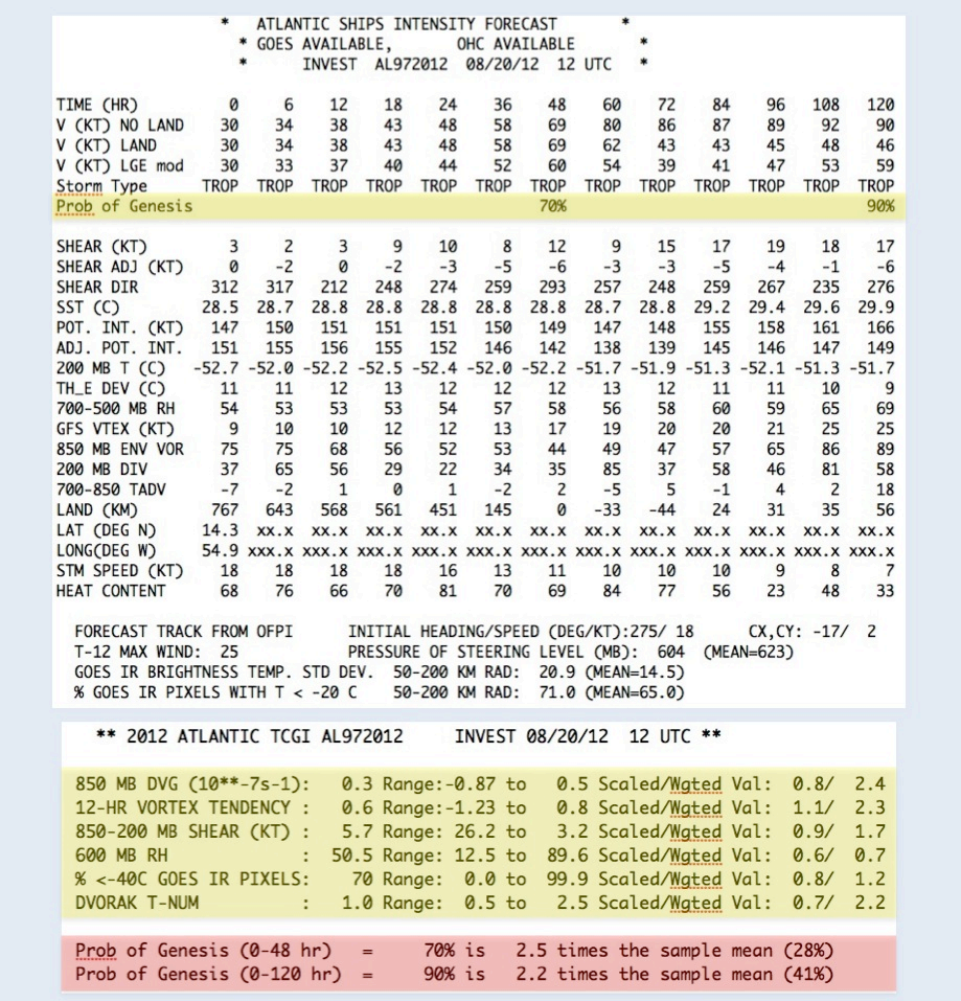


Figure 2. Skill of the TCGI relative to an all "yes" forecast (left), an all "no" forecast (middle), and climatology (right).

b. Develop code for running TCGI in real time (0-48h and 0-12h).

Real-time TCGI code development is currently underway. The TCGI real-time resting could be run in real-time at CIRA and provide 0-48h and 0-120h probabilities of TC formation for invest disturbances of interest. Pending project acceptance, it is proposed that the TCGI output be could be displayed as a part of the Statistical Hurricane Intensity Prediction Scheme (SHIPS) text output file. An example of the possible output format is shown in Figure 3.



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                *   ATLANTIC SHIPS INTENSITY FORECAST       *
                  * GOES AVAILABLE,       OHC AVAILABLE       *
                  *      INVEST  AL972012  08/20/12  12 UTC   *

TIME (HR)          0     6    12    18    24    36    48    60    72    84    96   108   120
V (KT) NO LAND    30    34    38    43    48    58    69    80    86    87    89    92    90
V (KT) LAND       30    34    38    43    48    58    69    62    43    43    45    48    46
V (KT) LGE mod    30    33    37    40    44    52    60    54    39    41    47    53    59
Storm Type      TROP  TROP  TROP  TROP  TROP  TROP  TROP  TROP  TROP  TROP  TROP  TROP  TROP
Prob of Genesis                                       70%                                 90%

SHEAR (KT)         3     2     3     9    10     8    12     9    15    17    19    18    17
SHEAR ADJ (KT)     0    -2     0    -2    -3    -5    -6    -3    -3    -5    -4    -1    -6
SHEAR DIR        312   317   212   248   274   259   293   257   248   259   267   235   276
SST (C)         28.5  28.7  28.8  28.8  28.8  28.8  28.8  28.7  28.8  29.2  29.4  29.6  29.9
POT. INT. (KT)   147   150   151   151   151   150   149   147   148   155   158   161   166
ADJ. POT. INT.   151   155   156   155   152   146   142   138   139   145   146   147   149
200 MB T (C)   -52.7 -52.0 -52.2 -52.5 -52.4 -52.0 -52.2 -51.7 -51.9 -51.3 -52.1 -51.3 -51.7
TH_E DEV (C)      11    11    12    13    12    12    12    13    12    11    11    10     9
700-500 MB RH     54    53    53    53    54    57    58    56    58    60    59    65    69
GFS VTEX (KT)      9    10    10    12    12    13    17    19    20    20    21    25    25
850 MB ENV VOR    75    75    68    56    52    53    44    49    47    57    65    86    89
200 MB DIV        37    65    56    29    22    34    35    85    37    58    46    81    58
700-850 TADV      -7    -2     1     0     1    -2     2    -5     5    -1     4     2    18
LAND (KM)        767   643   568   561   451   145     0   -33   -44    24    31    35    56
LAT (DEG N)     14.3  xx.x  xx.x  xx.x  xx.x  xx.x  xx.x  xx.x  xx.x  xx.x  xx.x  xx.x  xx.x
LONG(DEG W)     54.9 xxx.x xxx.x xxx.x xxx.x xxx.x xxx.x xxx.x xxx.x xxx.x xxx.x xxx.x xxx.x
STM SPEED (KT)    18    18    18    18    16    13    11    10    10    10     9     8     7
HEAT CONTENT      68    76    66    70    81    70    69    84    77    56    23    48    33

 FORECAST TRACK FROM OFPI      INITIAL HEADING/SPEED (DEG/KT):275/ 18      CX,CY: -17/  2
 T-12 MAX WIND:  25            PRESSURE OF STEERING LEVEL (MB):  604  (MEAN=623)
 GOES IR BRIGHTNESS TEMP. STD DEV.  50-200 KM RAD:  20.9 (MEAN=14.5)
 % GOES IR PIXELS WITH T < -20 C    50-200 KM RAD:  71.0 (MEAN=65.0)

  ** 2012 ATLANTIC TCGI AL972012     INVEST 08/20/12  12 UTC **

850 MB DVG (10**-7s-1):   0.3 Range:-0.87 to   0.5 Scaled/Wgted Val:  0.8/  2.4
12-HR VORTEX TENDENCY :   0.6 Range:-1.23 to   0.8 Scaled/Wgted Val:  1.1/  2.3
850-200 MB SHEAR (KT) :   5.7 Range: 26.2 to   3.2 Scaled/Wgted Val:  0.9/  1.7
600 MB RH             :  50.5 Range: 12.5 to  89.6 Scaled/Wgted Val:  0.6/  0.7
% <-40C GOES IR PIXELS:    70 Range:  0.0 to  99.9 Scaled/Wgted Val:  0.8/  1.2
DVORAK T-NUM          :   1.0 Range:  0.5 to   2.5 Scaled/Wgted Val:  0.7/  2.2

Prob of Genesis (0-48 hr)   =     70% is   2.5 times the sample mean (28%)
Prob of Genesis (0-120 hr)  =     90% is   2.2 times the sample mean (41%)
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Figure 3. Proposed output format for the TCGI (incorporated into the SHIPS text output data file).

3. Current / Future Year 2 Efforts:

With the completion of the development and sensitivity testing of the TCGI algorithm, the remainder of the Year 2 efforts will focus on operational code development and real-time testing of the TCGI. These efforts will include:

Dec 2012 (ongoing)	Develop code for running real-time TCGI (0-48h and 0-120h)
March 2013	Present year-2 results at IHC
June-Aug 2013	Perform real-time tests of TCGI (0-48h and 0-120h) either on NESDS computers at CIRA with output being made available via an ftp site or on JHT computers
Aug 2013	Final TCGI code for computing new TC genesis scheme will be made available and could be installed on the IBM as part of operational SHIPS/LGEM guidance suite (pending project acceptance).