

Adding probabilistic verification to the tc_gen algorithm

- There are two main components that need to be incorporated in the tc_gen algorithm for verifying probabilistic forecasts in order to satisfy applications at NHC and EMC.
- Component 1: Apply the existing tc_gen OPS scoring algorithm to model forecasts with genesis probabilities in ATCF e-deck format.
- Component 2: Verify probabilistic TC genesis forecasts from NHC's Tropical Weather Outlook files.

Component 1: Supporting ATCF e-deck files

- Read forecast information from the ATCF e-deck files and apply the existing tc_gen OPS scoring algorithm.
- Output PCT, PSTD, PRC line types.
- Output matched pair ASCII file (can be non-standard, similar to existing tc_gen matched pair output).

Component 1: Supporting ATCF e-deck files example

- Hypothetical e-deck contents:
 - AL, 78, 2020071912, GN, GFSO, 48, 102N, 455W, 9, 48, JHT, genFcst, 2020072306, ...
 - AL, 78, 2020071912, GN, GFSO, 48, 102N, 455W, 23, 120, JHT, genFcst, 2020072306, ...
 - AL, 78, 2020071912, GN, GFSO, 48, 102N, 455W, 42, 168, JHT, genFcst, 2020072306, ...
- AL: basin
- 78: Arbitrary storm ID (does not match ATCF b-deck/BEST storm ID)
- 2020071912: Model initialization time
- GN: Genesis forecast; GFSO: Model/technique; 48: 0-48 h period
- 102N: Forecast genesis LAT; 455W: Forecast genesis LON
- 9, 48: 9% probability of genesis within 48 h
- 23, 120: 23% probability of genesis within 120 h
- 42, 168: 42% probability of genesis within 168 h
- JHT: Forecaster initials or technique; genFcst: denotes a genesis forecast
- 2020072306: Forecast genesis valid time

Component 1: Supporting ATCF e-deck files example

- Hypothetical e-deck contents:
 - AL, 78, 2020071912, GN, GFSO, 48, 102N, 455W, 9, 48, JHT, genFcst, 2020072306, ...
 - AL, 78, 2020071912, GN, GFSO, 48, 102N, 455W, 23, 120, JHT, genFcst, 2020072306, ...
 - AL, 78, 2020071912, GN, GFSO, 48, 102N, 455W, 42, 168, JHT, genFcst, 2020072306, ...
- b-deck contents:

AL, 07, 2020072106,		BEST,	0,	88N,	388W,	25,	1009,	LO,	0,	,	0,	0,	0,	0,	1012,
AL, 07, 2020072112,		BEST,	0,	92N,	393W,	25,	1009,	LO,	0,	,	0,	0,	0,	0,	1012,
AL, 07, 2020072118,		BEST,	0,	97N,	400W,	30,	1008,	TD,	0,	,	0,	0,	0,	0,	1012,
AL, 07, 2020072200,		BEST,	0,	98N,	409W,	30,	1008,	TD,	0,	,	0,	0,	0,	0,	1012,
AL, 07, 2020072206,		BEST,	0,	98N,	419W,	35,	1006,	TS,	34,	NEQ,	20,	0,	0,	20,	1011,
AL, 07, 2020072212,		BEST,	0,	99N,	430W,	40,	1003,	TS,	34,	NEQ,	20,	0,	0,	20,	1011,
AL, 07, 2020072218,		BEST,	0,	99N,	442W,	45,	1000,	TS,	34,	NEQ,	30,	10,	10,	30,	1011,
AL, 07, 2020072300,		BEST,	0,	99N,	454W,	50,	998,	TS,	34,	NEQ,	30,	10,	10,	30,	1011,
AL, 07, 2020072300,		BEST,	0,	99N,	454W,	50,	998,	TS,	50,	NEQ,	10,	0,	0,	10,	1011,
AL, 07, 2020072306,		BEST,	0,	97N,	466W,	55,	997,	TS,	34,	NEQ,	30,	10,	10,	30,	1011,
AL, 07, 2020072306,		BEST,	0,	97N,	466W,	55,	997,	TS,	50,	NEQ,	10,	0,	0,	10,	1011,

- At the forecast genesis valid time (2020072306), there is a corresponding match in the b-decks.

Component 1: Supporting ATCF e-deck files example

- Hypothetical e-deck contents:
 - AL, 78, 2020071912, GN, GFSO, 48, 102N, 455W, 9, 48, JHT, genFcst, 2020072306, ...
 - AL, 78, 2020071912, GN, GFSO, 48, 102N, 455W, 23, 120, JHT, genFcst, 2020072306, ...
 - AL, 78, 2020071912, GN, GFSO, 48, 102N, 455W, 42, 168, JHT, genFcst, 2020072306, ...
- b-deck contents:

AL, 07, 2020072106,	, BEST,	0, 88N, 388W, 25, 1009, LO, 0,	, 0, 0, 0, 0, 1012,
AL, 07, 2020072112,	, BEST,	0, 92N, 393W, 25, 1009, LO, 0,	, 0, 0, 0, 0, 1012,
AL, 07, 2020072118,	, BEST,	0, 97N, 400W, 30, 1008, TD, 0,	, 0, 0, 0, 0, 1012,
AL, 07, 2020072200,	, BEST,	0, 98N, 409W, 30, 1008, TD, 0,	, 0, 0, 0, 0, 1012,
AL, 07, 2020072206,	, BEST,	0, 98N, 419W, 35, 1006, TS, 34, NEQ,	20, 0, 0, 20, 1011,
AL, 07, 2020072212,	, BEST,	0, 99N, 430W, 40, 1003, TS, 34, NEQ,	20, 0, 0, 20, 1011,
AL, 07, 2020072218,	, BEST,	0, 99N, 442W, 45, 1000, TS, 34, NEQ,	30, 10, 10, 30, 1011,
AL, 07, 2020072300,	, BEST,	0, 99N, 454W, 50, 998, TS, 34, NEQ,	30, 10, 10, 30, 1011,
AL, 07, 2020072300,	, BEST,	0, 99N, 454W, 50, 998, TS, 50, NEQ,	10, 0, 0, 10, 1011,
AL, 07, 2020072306,	, BEST,	0, 97N, 466W, 55, 997, TS, 34, NEQ,	30, 10, 10, 30, 1011,

- The BEST genesis time for this system is 2020072118. Therefore, this forecast would be a HIT at 120 and 168 h, but a FALSE ALARM at 48 h.

Component 2: Supporting Tropical Weather Outlook files

- Read forecast information from the Tropical Weather Outlook files and determine whether TC genesis occurred within X hours for each forecast.
- Output PCT, PSTD, PRC line types.
- Output matched pair ASCII file (can be non-standard, similar to existing tc_gen matched pair output).

Component 2: Supporting Tropical Weather Outlook files

- Each disturbance that is included in NHC's Tropical Weather Outlook has its own Tropical Weather Outlook file. These files follow the naming convention abYYYYinvXYZ.txt where:
 - “ab” is the two-letter basin identifier (al for Atlantic, ep for East Pacific)
 - YYYY is the four-digit year
 - XYZ is the number of the disturbance (not the same as the ATCF b-deck/BEST storm ID)

Component 2: Supporting Tropical Weather Outlook files

- Contents of al2020inv018.txt:
 - The first line contains the file name and the ATCF storm ID if the system developed.
 - In this case, the disturbance developed into AL082020.
 - The remaining lines are formatted as:
 - Tropical Weather Outlook issuance time (MMDDHHmm)
 - 48 h genesis probability
 - 120 h genesis probability
 - 168 h genesis probability
 - Forecaster's initials

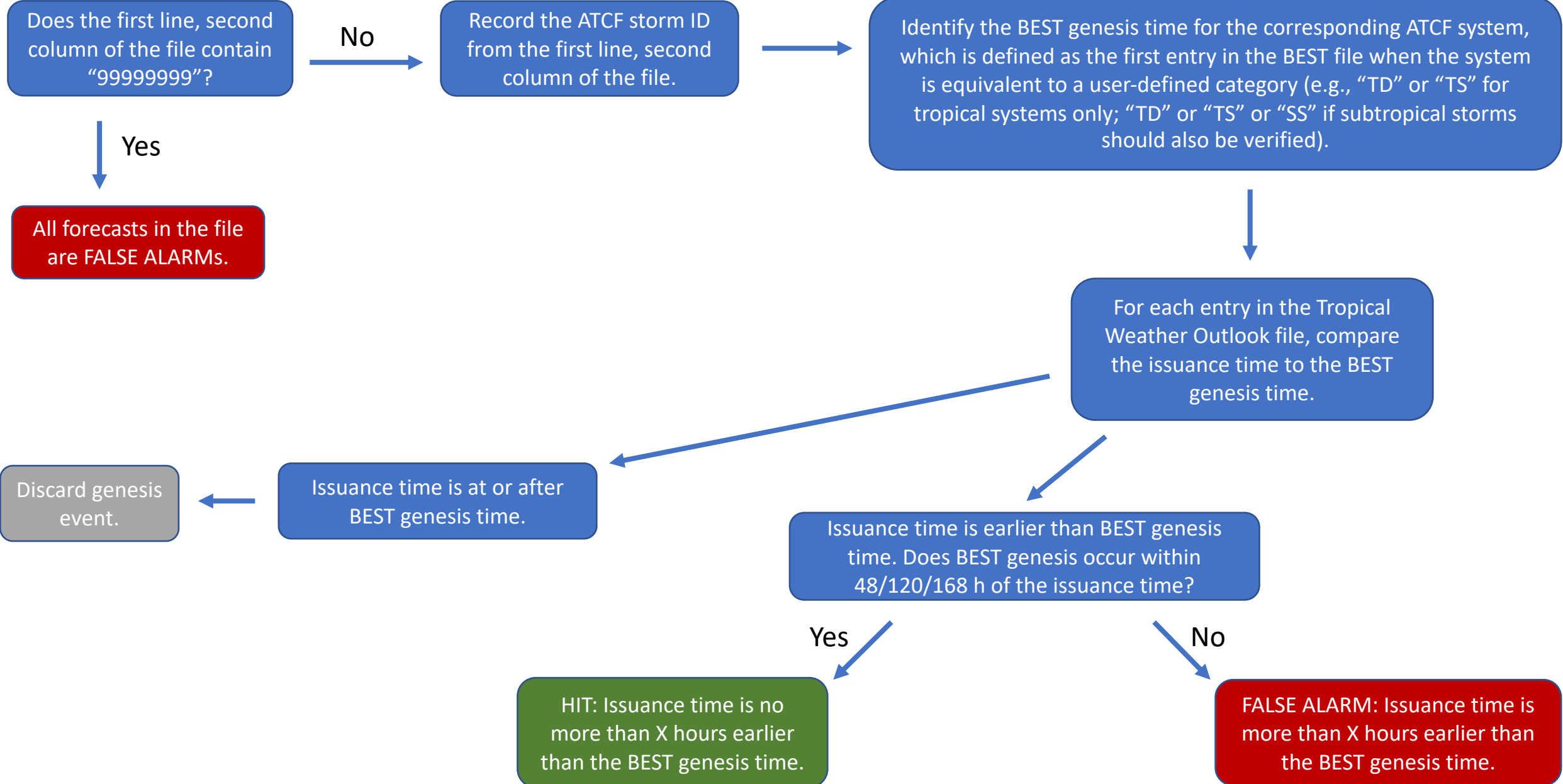
```
al2020inv018 al082020
07171800 000 000 010 RJB
07180000 000 000 010 RJP
07180600 000 000 010 RJP
07181200 000 000 010 JLB
07181800 000 000 010 DAZ
07190000 000 010 010 RJP
07190600 000 020 020 SRS
07191200 000 020 020 JLB
07191800 000 020 020 JLB
07200000 000 020 020 JLB
07200600 000 020 020 SRS
07201200 010 020 020 JLB
07201800 020 020 020 JLB
07210000 020 030 030 JPC
07210600 030 030 030 SRS
07211200 030 040 040 JLB
07211800 030 040 040 JLB
07220000 030 040 040 JPC
07220600 030 040 040 RJP
07221200 040 050 050 JLB
07221800 070 080 080 JLB
07230000 080 090 090 JPC
```


Component 2: Supporting Tropical Weather Outlook files

- Non-developing disturbances are formatted the same way, except the first line contains “99999999” instead of an ATCF storm ID:

```
a12020inv017 99999999  
07060000 010 010 010 ESB  
07060600 010 010 010 JLB  
07061200 010 010 010 DAZ  
07061800 010 010 010 DAZ  
07070000 000 000 000 ESB
```

Logic for verifying Tropical Weather Outlook files



Component 2: Supporting Tropical Weather Outlook files example

Forecast probabilities for
al2020inv018 (became AL082020).

```
al2020inv018 al082020
07171800 000 000 010 RJB
07180000 000 000 010 RJP
07180600 000 000 010 RJP
07181200 000 000 010 JLB
07181800 000 000 010 DAZ
07190000 000 010 010 RJP
07190600 000 020 020 SRS
07191200 000 020 020 JLB
07191800 000 020 020 JLB
07200000 000 020 020 JLB
07200600 000 020 020 SRS
07201200 010 020 020 JLB
07201800 020 020 020 JLB
07210000 020 030 030 JPC
07210600 030 030 030 SRS
07211200 030 040 040 JLB
07211800 030 040 040 JLB
07220000 030 040 040 JPC
07220600 030 040 040 RJP
07221200 040 050 050 JLB
07221800 070 080 080 JLB
07230000 080 090 090 JPC
```

BEST entries for AL082020. Highlighted line is BEST genesis.

```
AL, 08, 2020072212, , BEST, 0, 255N, 873W, 25, 1011, DB, 0,
AL, 08, 2020072218, , BEST, 0, 256N, 878W, 30, 1011, LO, 0,
AL, 08, 2020072300, , BEST, 0, 257N, 883W, 25, 1009, TD, 0,
AL, 08, 2020072306, , BEST, 0, 258N, 890W, 25, 1009, TD, 0,
```

168 h probability HITs

120 h probability HITs

48 h probability HITs