Joint Hurricane Testbed

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Improvements and extensions to an existing probabilistic TC genesis forecast tool using an ensemble of global models

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Semi-Annual Progress Report

1. Accomplishments

a. Maintained moe website to disseminate current guidance

The web site to disseminate the guidance products (http://moe.met.fsu.edu/modelgen) was very reliably maintained throughout the 2018 hurricane season, with the exception being for a few days during the impacts of Hurricane Michael on the FSU campus. Guidance products are updated four times daily, with the arrival of each model cycle.

b. Scripts for all real-time guidance products transferred to NHC

Many of the early tasks for this project involve converting existing code to languages that are compatible with NHC's IT infrastructure. All of the code for the real-time products have been converted to Python or c-shell from GrADS or R. These new scripts were tested on the FSU version of the guidance tool during much of the 2018 hurricane season. Following successful testing, these scripts were transferred to JHT staff at NHC.

c. Evaluation of fvGFS TC genesis forecasts complete

A set of retrospective forecasts from the fvGFS were generated for the 2015-2018 hurricane seasons. We verified the TC genesis forecasts from this dataset and compared it to a homogeneous set of forecasts from the operational GFS. The fvGFS exhibited a larger success ratio (SR) with a similar probability of detection (POD) compared to the GFS over the North Atlantic basin. Meanwhile over the eastern North Pacific, the fvGFS appears to be less cyclogenetic than the GFS – fvGFS exhibited a larger SR, but a smaller POD than the GFS. This task was completed several months early to satisfy the fvGFS evaluation deadline set by EMC.

d. Redesigned website operational

The redesigned website that was running in a test mode during the last progress report is now operational (http://moe.met.fsu.edu/modelgen). This redesigned site should allow NHC forecasters to access the guidance products for all models in a more time-efficient manner.

e. Real-time products using modified tracker running in test mode

As indicated in the previous progress report, one weakness of the current version of the guidance is low probability of detection (POD) for TCs with baroclinic genesis pathways. Therefore, we tested the TC genesis verification statistics using several different threshold values of thickness and thickness anomaly. As expected, reducing the threshold values does increase the POD of TCs that form poleward of 25°N. However, it is unclear if this benefit outweighs the vastly increased number of false alarms. We ran a parallel version of the guidance tool with a modified tracker in test mode (http://moe.met.fsu.edu/modelgentest) during the second half of the 2018 hurricane season. Verification is in progress to determine whether these probabilities were more or less reliable than probabilities generated by the operational tracker.

2. Products

All of the guidance products are available at http://moe.met.fsu.edu/modelgen. All of the code for the real-time guidance is now in Python or c-shell. The updated consensus tracker has been implemented.

3. Participants and other collaborating organizations

The PI and Co-PI are the primary participants on this project. They continue to collaborate with their NHC/JHT points-of-contact: Richard Pasch and Matt Onderlinde. Other NHC personnel, including Mark DeMaria, Andy Penny, Mike Brennan, Eric Blake, and Robbie Berg have participated in planning meetings and/or provided feedback on the guidance.

There were no other organizations formally involved in the project during the reporting period, although as noted above we accelerated original plans for the fvGFS evaluation of this genesis guidance evaluation to meet EMC's earlier evaluation deadline (and thus represents an informal collaboration).

4. Impact

The PIs have had extensive communication with several NHC forecasters regarding product availability and updates, suggesting that the products continue to be used at a high volume as previously. Web access logs at FSU reveal that the products are also being heavily used by the general public and/or forecasters outside of the NHC environment as well.

5. Changes/Problems

The operational model output archive is ready to transfer to NHC. However, we are awaiting the necessary data storage capabilities at NHC. In addition, a final decision has not yet been made regarding the subset of the data they wish to store (whether through interpolation, variable subsetting, or geographic subsetting).

Initially, the PIs had planned to take a trip to NHC during the Fall of 2018 to provide a research update and answer any implementation questions. Given the active hurricane season and the fact that some of the code was still running in test mode at that time, this planned trip has been postponed to Spring or Summer 2019. A one-year No-Cost-Time-Extension (NCTE) has been requested through FSU to ensure this travel is possible near the end of the project, or after the original project deadline has passed.

6. Special Reporting Requirements

We assess the Readiness Level of the project at the beginning of the project period as a 5 and currently as a 7.

7. Budgetary Information

The project is on budget. No deviations from the proposed budget are anticipated. However, as mentioned earlier, in order to ensure that a trip to NHC is possible near the end of the project (and also to allow for publication costs to be paid) a one-year No-Cost-Time-Extension (NCTE) has been requested via FSU.

8. Project Outcomes

It is difficult to quantify the project outcomes at this time. However, we are encouraged that NHC is running a parallel version of the guidance tool on the JHT workstation. We believe this indicates the project's potential to be transitioned to operations and its ability to achieve a Readiness Level of 9 by the end of the project cycle.

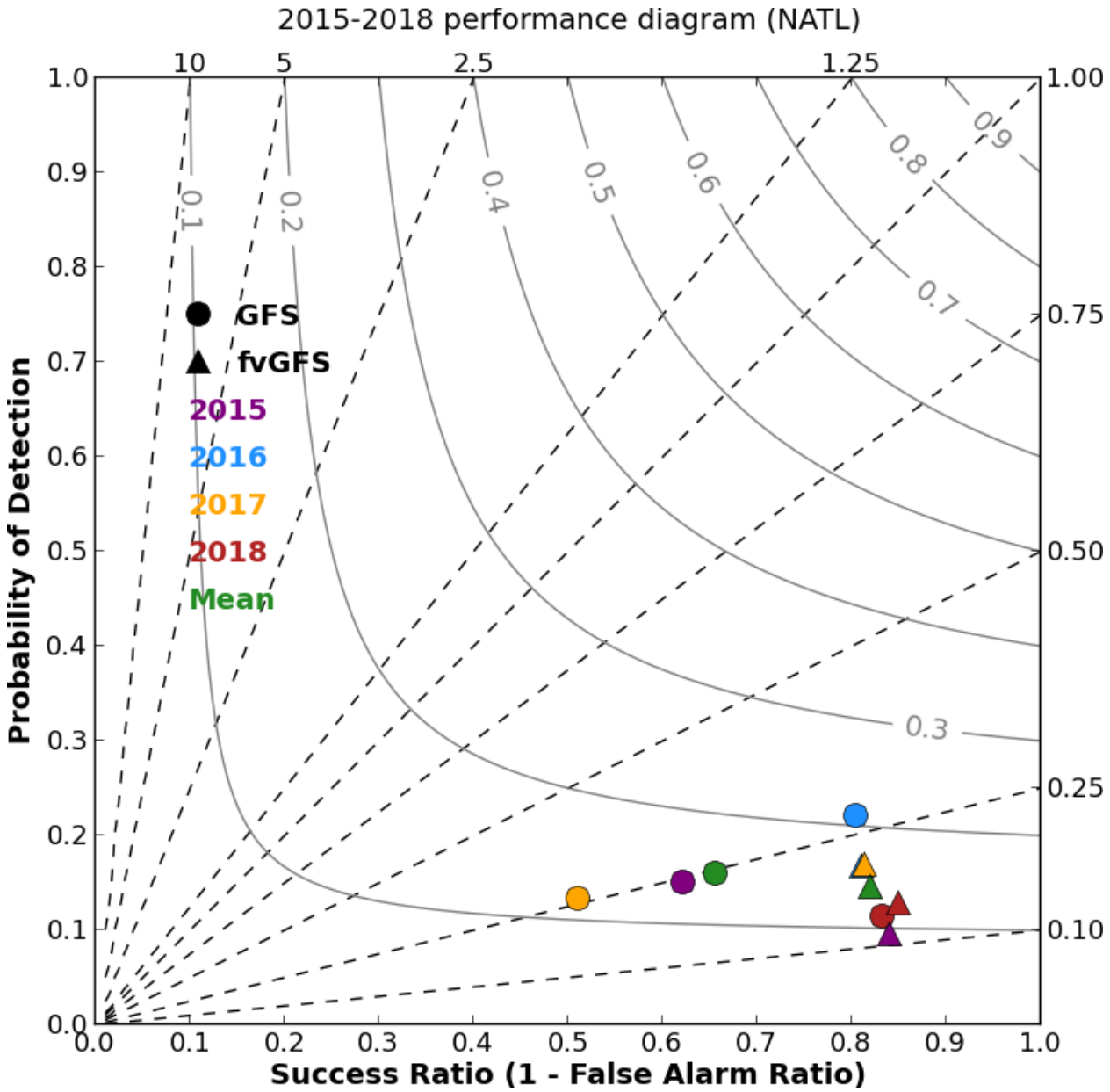

Fig. 1. Forecast verification by year for each model configuration over the North Atlantic basin. Success ratio is on the x-axis; probability of detection is on the y-axis; frequency bias is given by the dashed lines; critical success index is given by the gray, curved lines. If the model forecast every TC genesis event perfectly, all metrics would equal unity.

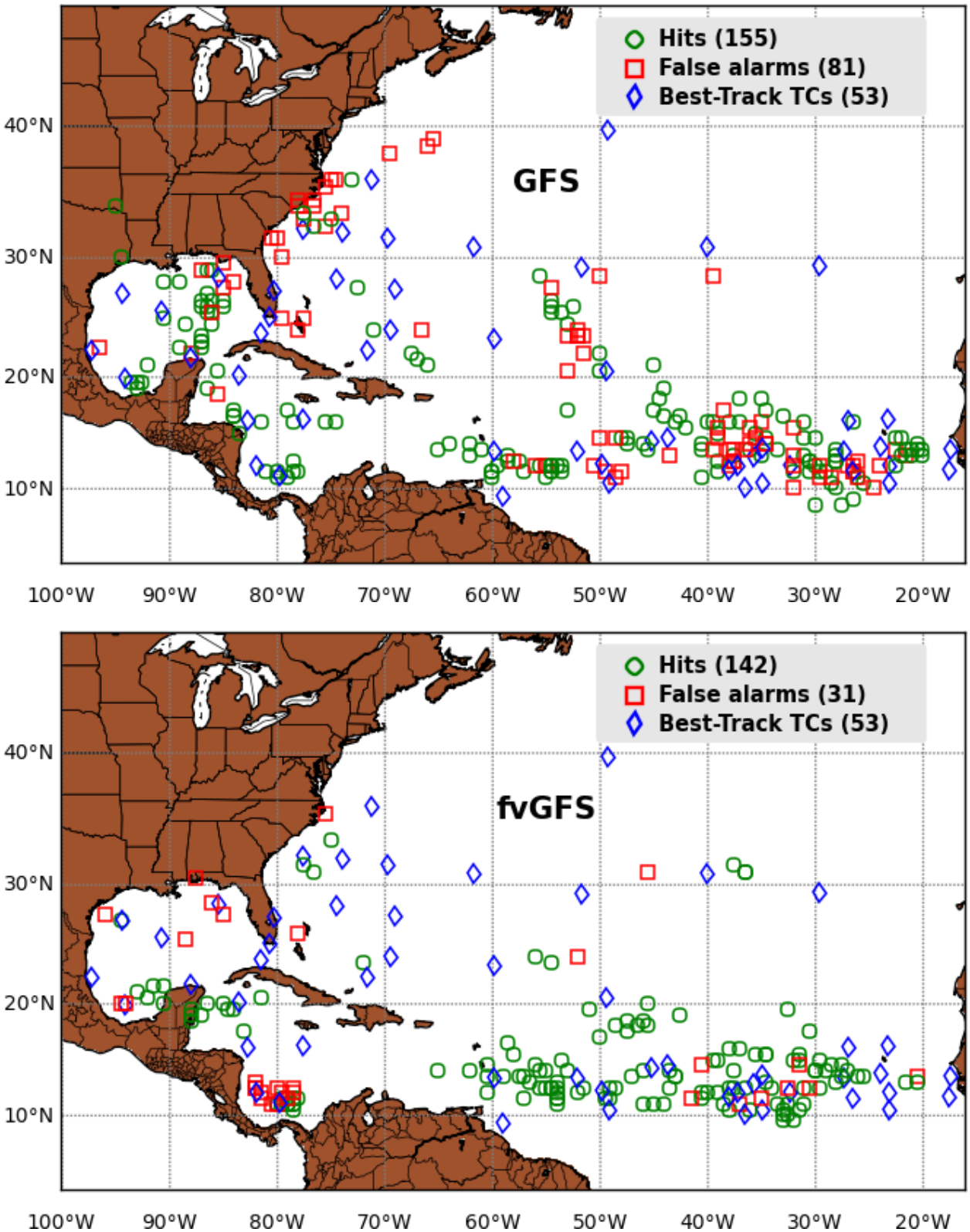

Fig. 2. Locations of all forecast hit events (green circles), false alarm events (red squares), and actual best-track TC genesis (blue diamonds) during the 2015-2018 study period for the GFS (top) and fvGFS (bottom).

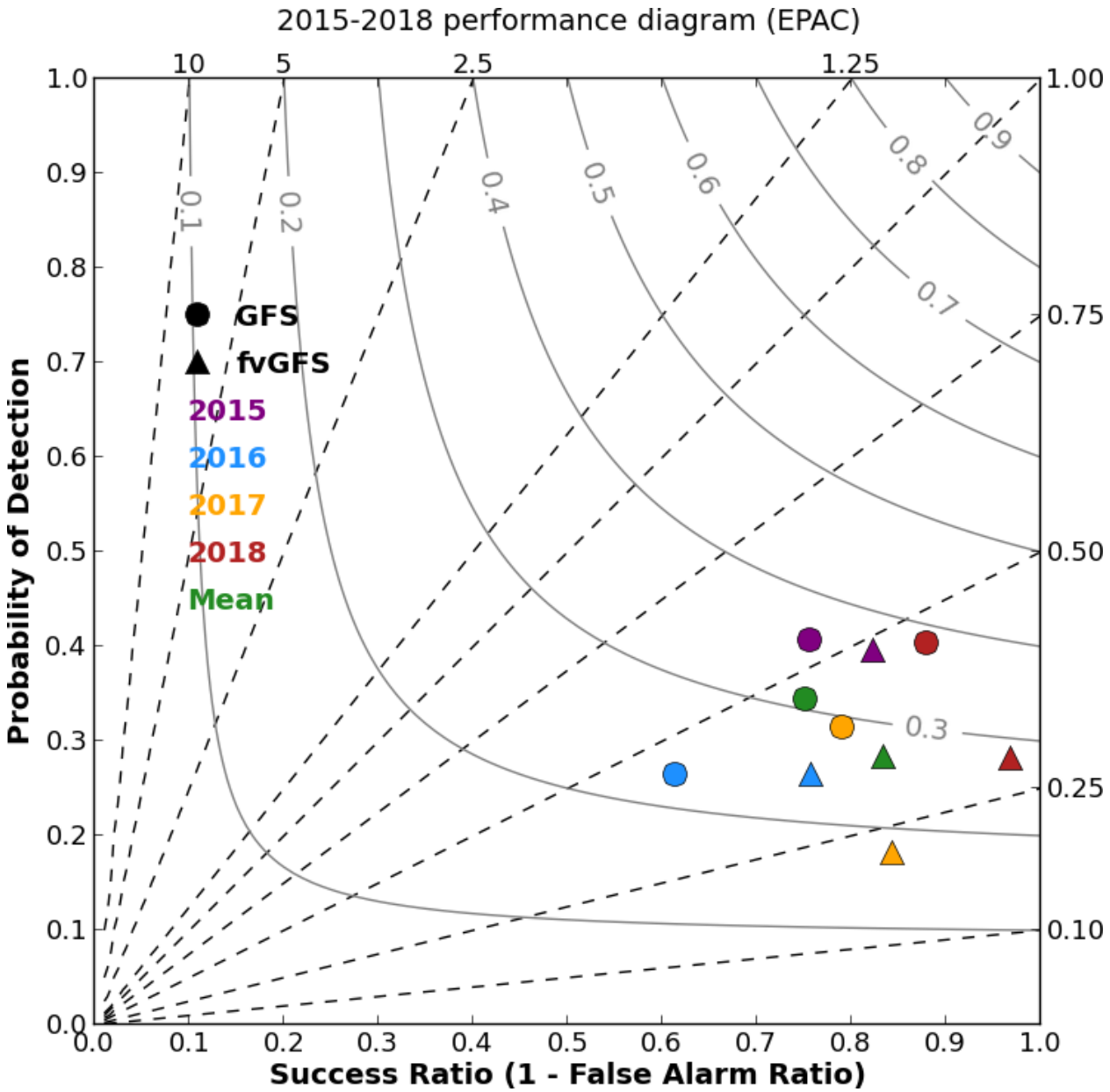

Fig. 3. As in Fig. 1, except for the eastern North Pacific basin.

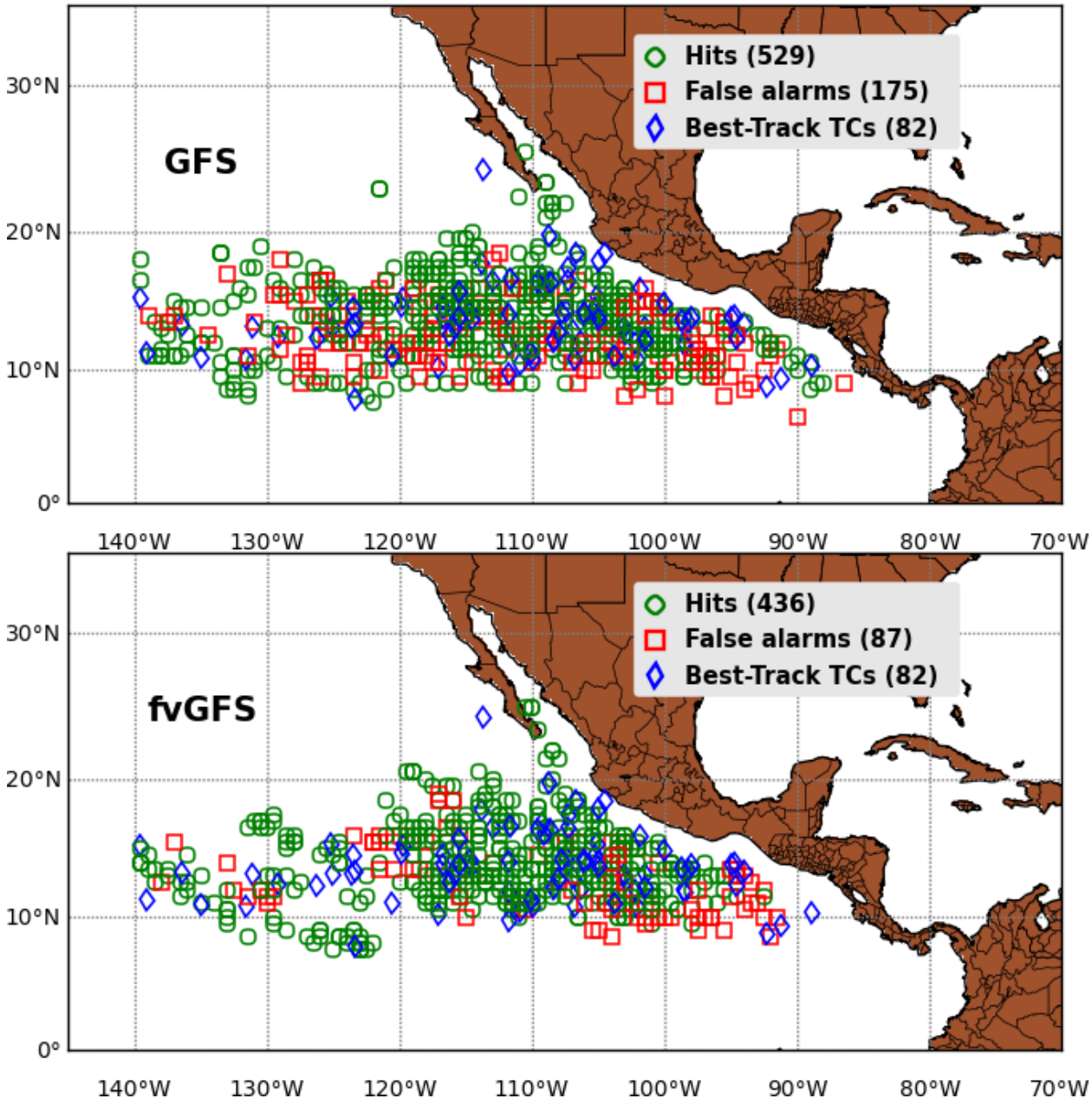

Fig. 4. As in Fig. 2, except for the eastern North Pacific basin.