The Effect of Landfall or Coastal Interaction on the Performance of Navy Tropical Cyclone Forecasts

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Objective

•This study was to determine, if there is an effect on Navy model intensity forecasts when only verification points in close proximity to landmasses greater than 800 KM² were considered. Tropical cyclones from the 2013 and 2014 seasons are used in this experiment.

Methodology

• Determine the storms from the 2013 and 2014 seasons that either made landfall or came within 30 KM of a sizeable landmass that was defined as that greater than 800 KM².

• Filter the Best Track (estimated) "bdeck" files for the above criteria for cases that are no more than 30 KM from land for at least two verifications.

• Run verification software to determine the intensity skill of the Navy models for the following categories all cases, >34 KT <64KT, and >64KT, for the filtered bdeck files.

• Run the same verification software, for the same categories on the unedited bdeck files, for all storms TD or stronger, in all basins.

• Isolate the cases that have the most influence on the resulting statistics.

Conclusions

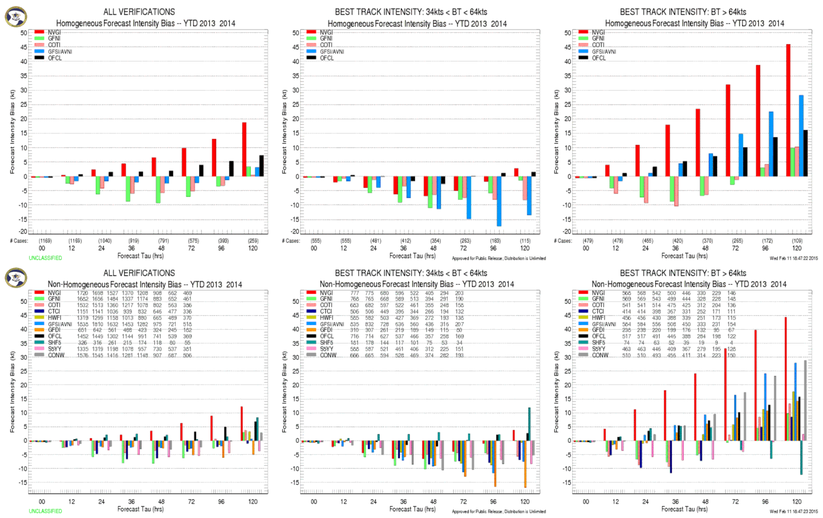
• There appears to be no standard bias in the Navy Models that covers all landfalling systems, except for the removal of a slight low bias seen in the operational sample.

• Each landfalling system creates a unique set of circumstances that effect the models with a great variety of possible reasons for these biases. EP152014 and SH172013 show that model forward speed has a likely effect on landfalling scores.

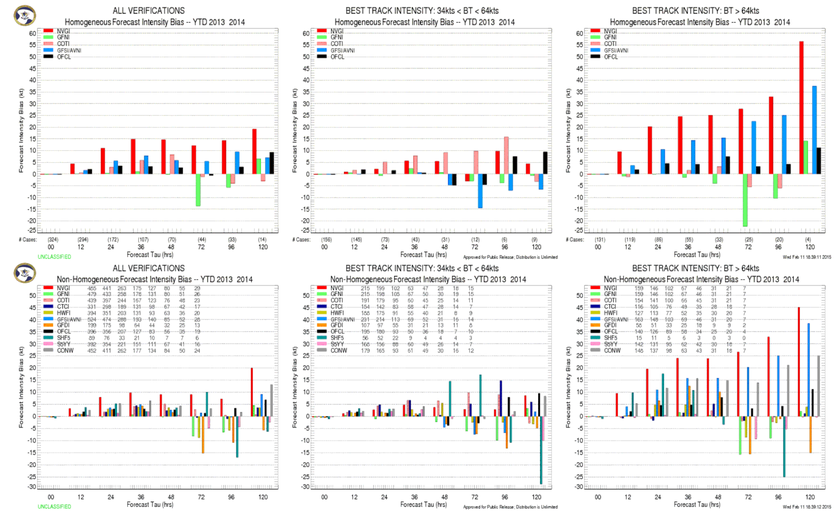
• Since so many factors are capable of causing differences between the model and truth, this study should be furthered by trying to isolate each cause and determine if a standard bias exists due to each cause.

•Subjectivity also comes in from this methodology and a standardization of what it means to "landfall" needs to be better determined.

Results for Operational Cases



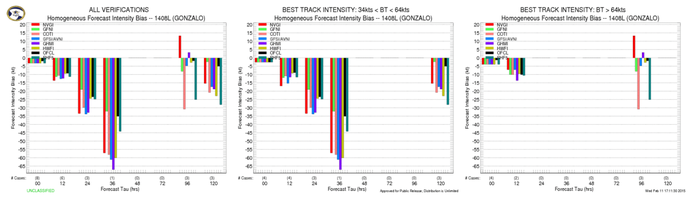
Results for Land Filtered Cases



Observations

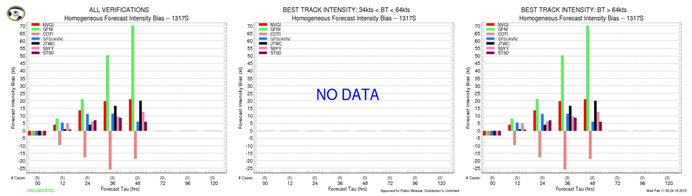
- For Tropical Depressions and Tropical Storms, models are uniformly low biased in the operational (OPS) sample, whereas they are more bifurcated in the filtered sample.
- Stronger storms (>64 KTS) have fewer differences between samples, though more low bias is seen in early forecasts with OPS, than with the filtered sample.

Analysis of the Most Influential Cases



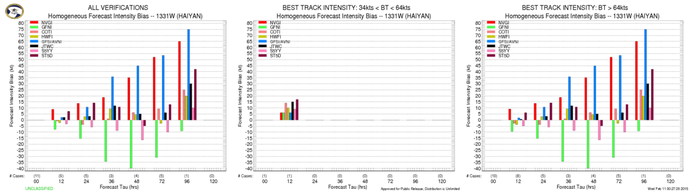
GONZALO (AL082014)

- Models failed to get Rapid Intensification (RI) during / just after Caribbean landfalls.
- Forecasts averaged 5-15kt low, but RI was most extreme just after landfall allowing 60 KT low bias errors where the models failed to strengthen enough. The NHC post-storm report seems to agree with this assessment.



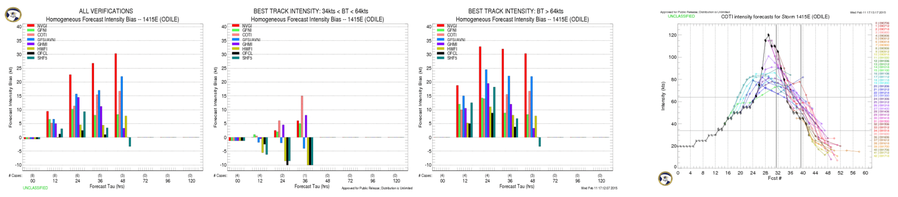
RUSTY (SH172013)

- COTI forecasts are too fast with landfall, resulting in low forecast biases.
- The GFNI forecasts stayed offshore too long, resulting in high bias errors.



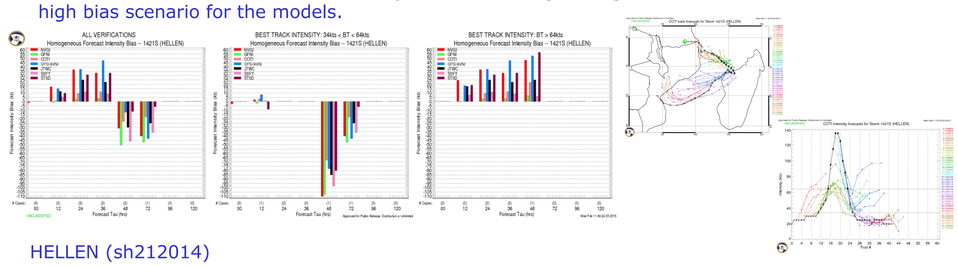
HAIYAN (WP312013)

- GFNI westward bias produced an early landfall forecast into Vietnam, resulting in a low bias.
- The COTI had excellent track and intensity forecasts. As previously noted, the NVGI doesn't forecast spin down over water (many storms), and therefore is too strong.



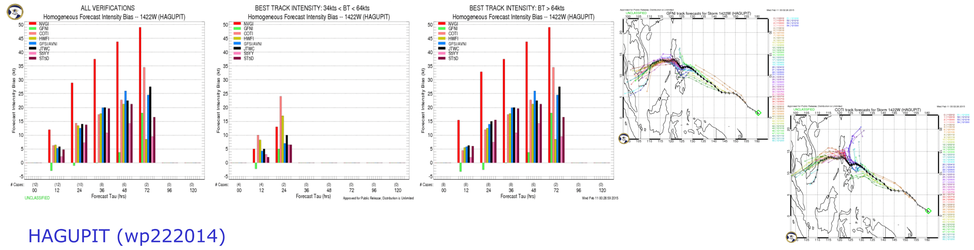
ODILE (EP152014)

- Models are faster up the Baja Peninsula, with less over-land weakening (less time over land); then stalled the storm over the Northern Gulf of CA., allowing less weakening.
- Best track slows the storm over the Baja Peninsula, lengthening time over land. Hence this high bias scenario for the models.



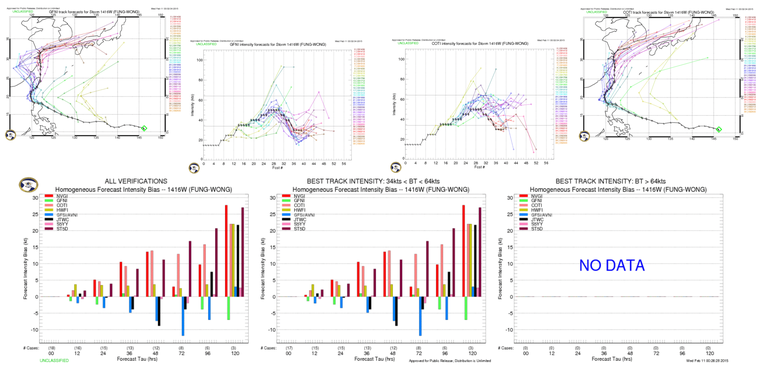
HELLEN (sh212014)

- For all models, long range forecasts have a low bias due to missed extreme RI.
- Short range forecasts are biased high due to the model's failure to fully reach land in the initial re-curve in most cases. The case exemplifies the complexity of this project.



HAGUPIT (wp222014)

- Storm track decelerated and experienced upper level subsidence within a Northeast surge event
- Naval models were producing recurving tracks with COTI being the last model to finally show landfall, NVGI next to last to show landfall. COTI and NVGI therefore have a high bias.
- GFNI (with westward bias) showed landfall and more properly captured the upper level environment seen west of the Philippines.



FUNG-WONG (wp162014)

- Models biased high forecast strong intensification between the Philippines and Taiwan which did not occur. Forecasts remain slow (easterly bias).
- Low biased model tracked the storm too westerly towards Taipei then Shanghai. The GFNI early west, then late easterly tracks resulted in little overall intensity bias.
- Models with an easterly track bias, had high intensity biases, as more time was spent over water. Inversely, having a westerly track bias, GFNI forecast the storm to spend more time over land, resulting in a slightly low intensity bias.