



Nearshore Wave Prediction System v1.2 CCB Meeting

André van der Westhuysen, Jian Kuang, Deanna Spindler, Roberto Padilla (NCEP)

Nicole Kurkowski, Dennis Atkinson (OST); John Kuhn (AFS);

Pablo Santos, Alex Gibbs, Joe Maloney (WFO-MFL), Doug Gaer, Jack Settelmaier (SRH); Ray Ball (WFO-MOB); Troy Nicolini, Sten Tjaden, Brian Garcia (WFO-EKA); Donnie King, Scott Kennedy (WFO-MHX), Carlos Anselmi (WFO-SJU), Eric Lau (PRH), Carl Dierking (WFO-JUN), Jim Nelson (WFO-ARH)

Jeffrey Hansson (USACE/CHL), Eve-Marie Devaliere (NESDIS/STAR),
Joe Long and Hilary Stockdon (USGS)

Internal presentation to EMC, Jul 6, 2017





Outline

1. Timeline of project (Quad chart)
2. Scope of changes
3. Resource changes
4. Timing of jobs
5. Data input/output additions
6. Validation results
7. User evaluation



NWPS Version 1.2.0

Status as of 06/26/17



Project Information & Highlights

Leads: Andre van der Westhuysen (EMC), Steven Earle (NCO)

Scope: Implement unstructured model meshes, and rip current and wave runup guidance (2 new products) for 10 WFOs. Extend forecast time to 6 days and increase output frequency to 1-hourly.

Expected benefits: Meet the needs of coastal WFOs for longer-term, higher-frequency nearshore wave and coastal hazard guidance.

Dependencies: AFS CaRDS processes for new products. AWIPS/GFE display modifications. External WFO evaluation. NCO IT readiness.

G Schedule

Milestones & Deliverables	Date	Status
Freeze system code; deliver to NCO if applicable	03/15/17	Completed
Complete full retrospective/real time runs and evaluation	07/01/17	On track
CCB/OD brief, and deliver final system code to NCO	07/10/17	On track
Issue Technical Information Notice	07/10/17	On track
Complete 30-day evaluation and IT testing	10/15/17	On track
Operational Implementation	10/31/17	On track

EMC	NCO	Red text indicates change from previous quarter
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Issues/Risks/Concerns

Issues: (1) Larger than usual HPSS increase, since it now includes inputs for retrospectives. Anticipate approval at HPCRAC of 07/17.

Risk: Timely inclusion of AWIPS/GFE modifications to display new products; **Mitigation:** Resolved: Coordinated development with AWIPS Program Office. Submitted RC and DCS for AWIPS build 17.3.1.



Resources

Staff: 0 Fed FTEs + 2 contractor FTEs (Andre v/d W, Jian Kuang)

Funding Source: 1 FTE base + 1 FTE soft funding OSTI

Compute: parallels: 36 nodes on Cray (2 months); **EMC Dev:** 36 nodes on Cray (6 months); **Ops:** 36 reserved nodes on Cray (x2 of current production).

Archive: 16.6 GB/day in HPSS 2-year (increase from 4 GB/day); 64 GB/day in HPSS 2-year for retrospectives (increase from 0 GB)

R Management Attention Required

Y Potential Management Attention Needed

G On Target



Scope of changes (1):

System upgrades

1. Forecast extended to 144h, 1-hourly output (from 102h/3hourly).
2. Transitioned 10 WFOs to unstructured meshes, incl. update to model core SWAN v41.10.
3. For 10 WFOs included experimental rip current and wave runup (erosion/overwash) guidance, for evaluation purposes.
4. Upgraded to new P-Surge (102h) and ESTOFS Atlantic inputs.

Bugzilla fixes, incl: (Discussed with NCO 06/21/17)

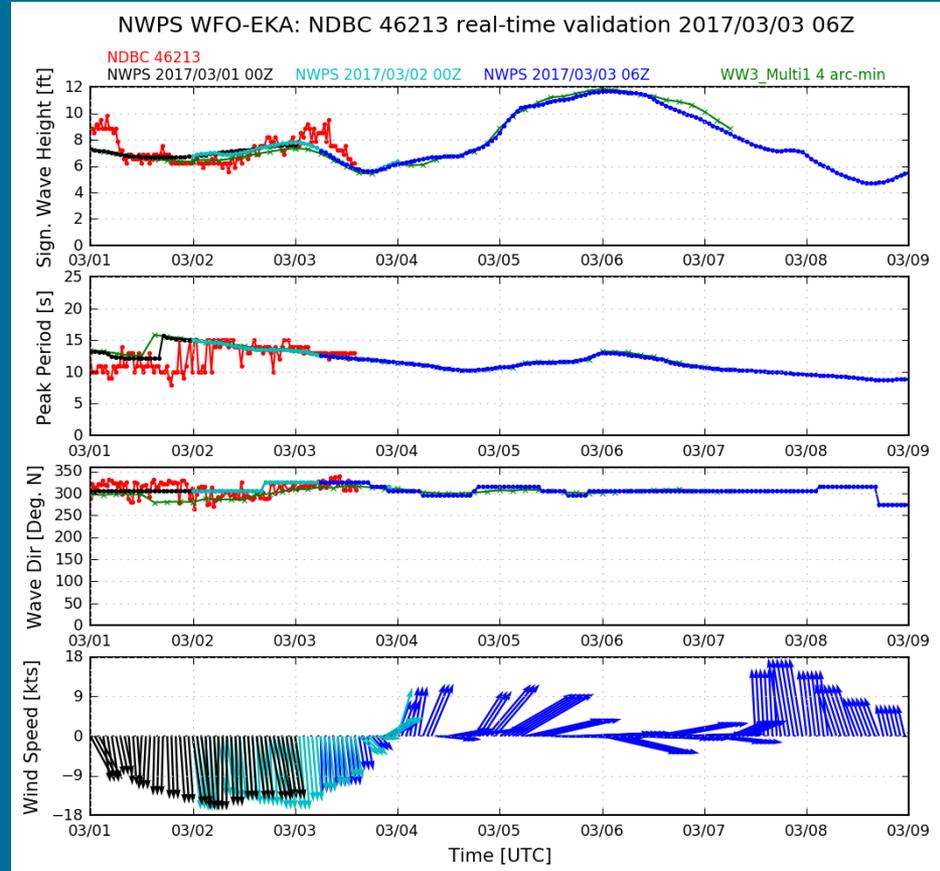
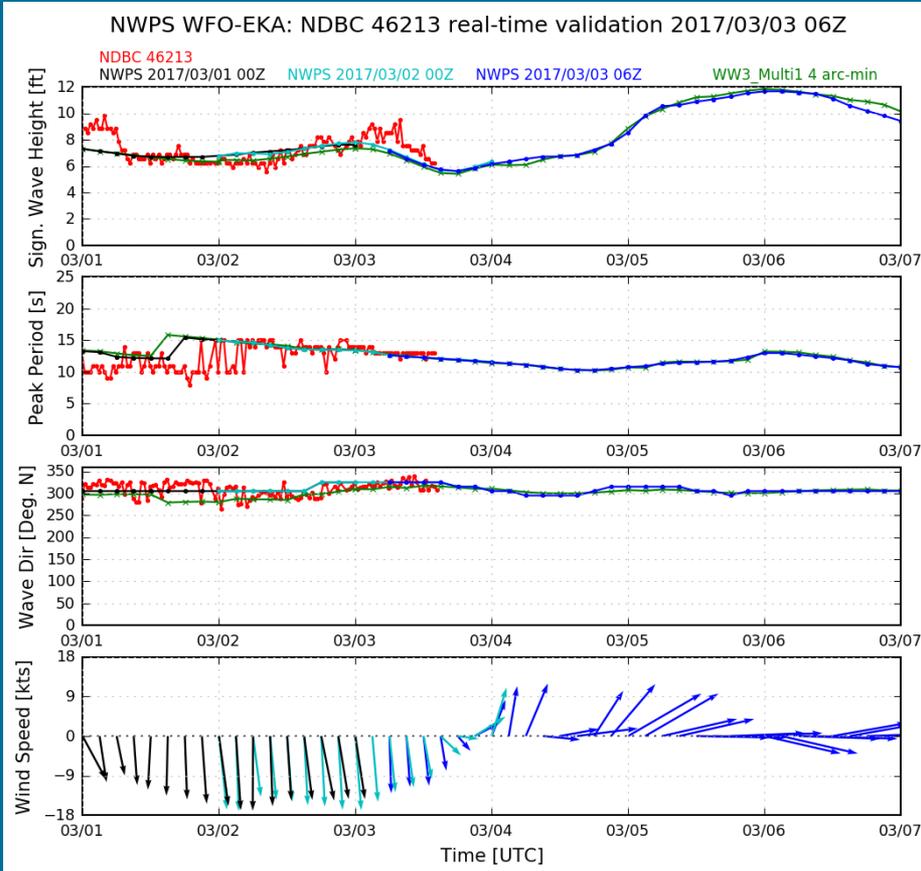
1. New GFS fail-over option, when GFE winds fail (#517).
2. Ability to rerun on-demand cycles with same inputs (#505,#543).



Scope of changes (2): Increase in forecast length, output frequency*

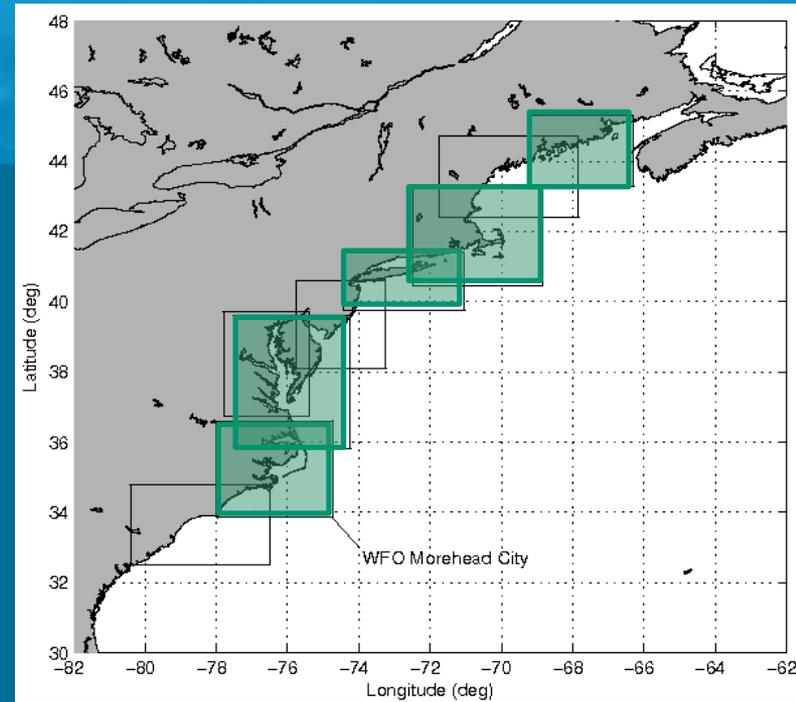
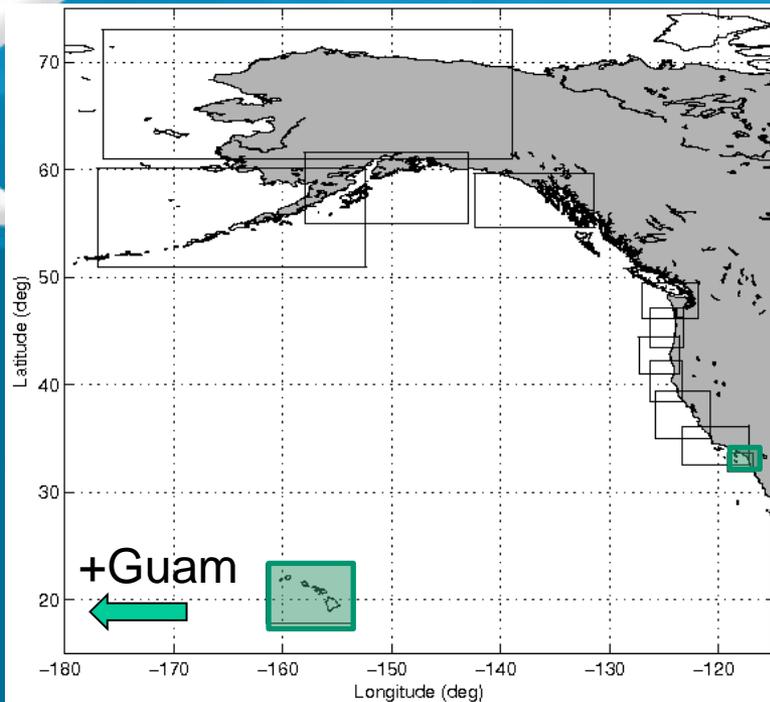
Prod: Forecast = 102h, 3-hourly

Upgrade: Forecast = 144h, 1-hourly



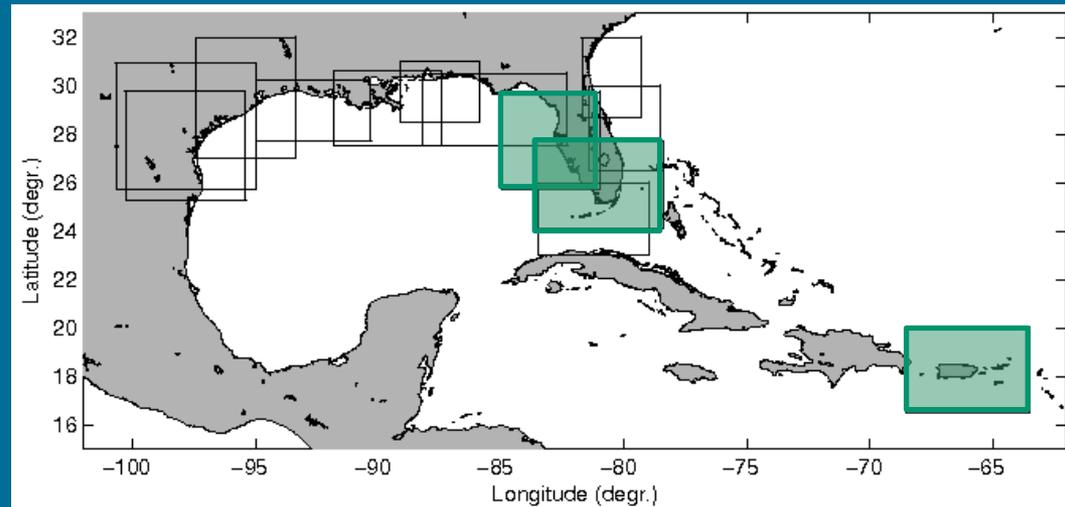
*Dataflow: Increase from 35 to 145 time levels per WFO per cycle

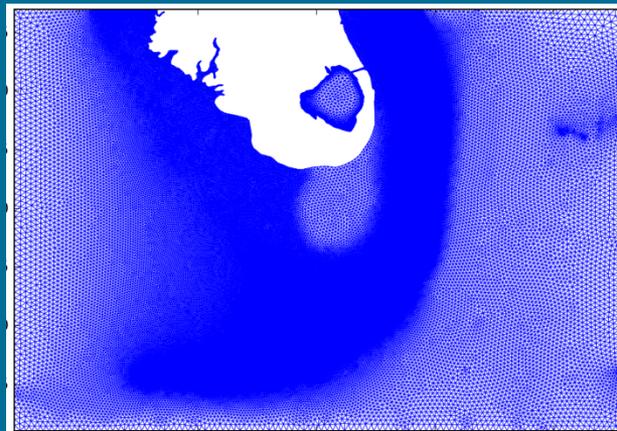
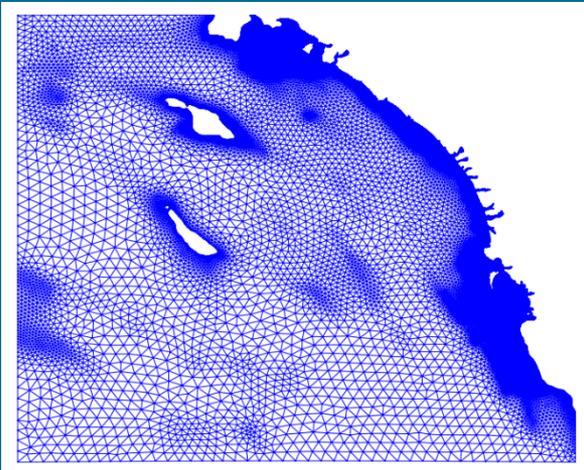
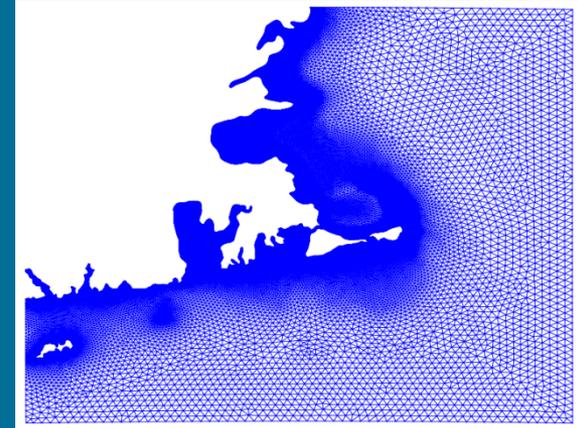
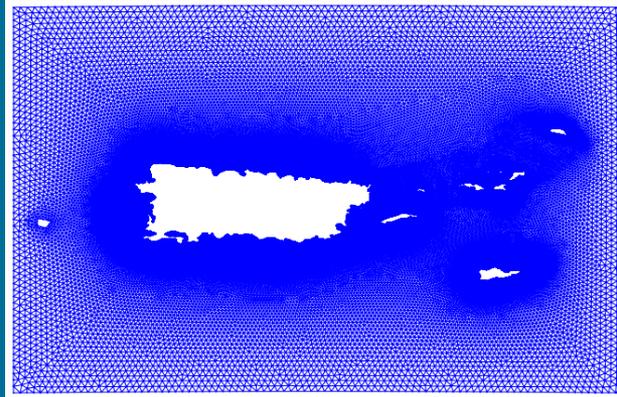
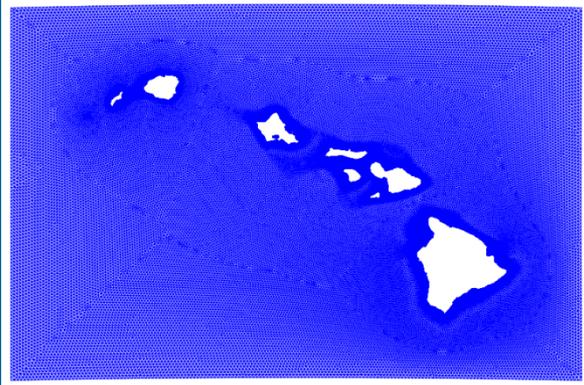
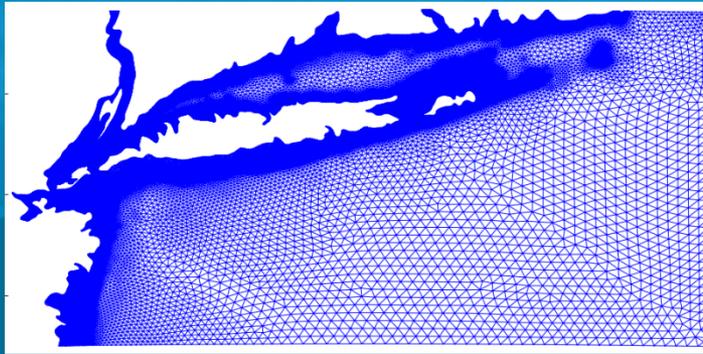




Scope of changes (3):

Unstructured meshes at 10 WFOs for evaluation of experimental rip current and erosion/overwash guidance



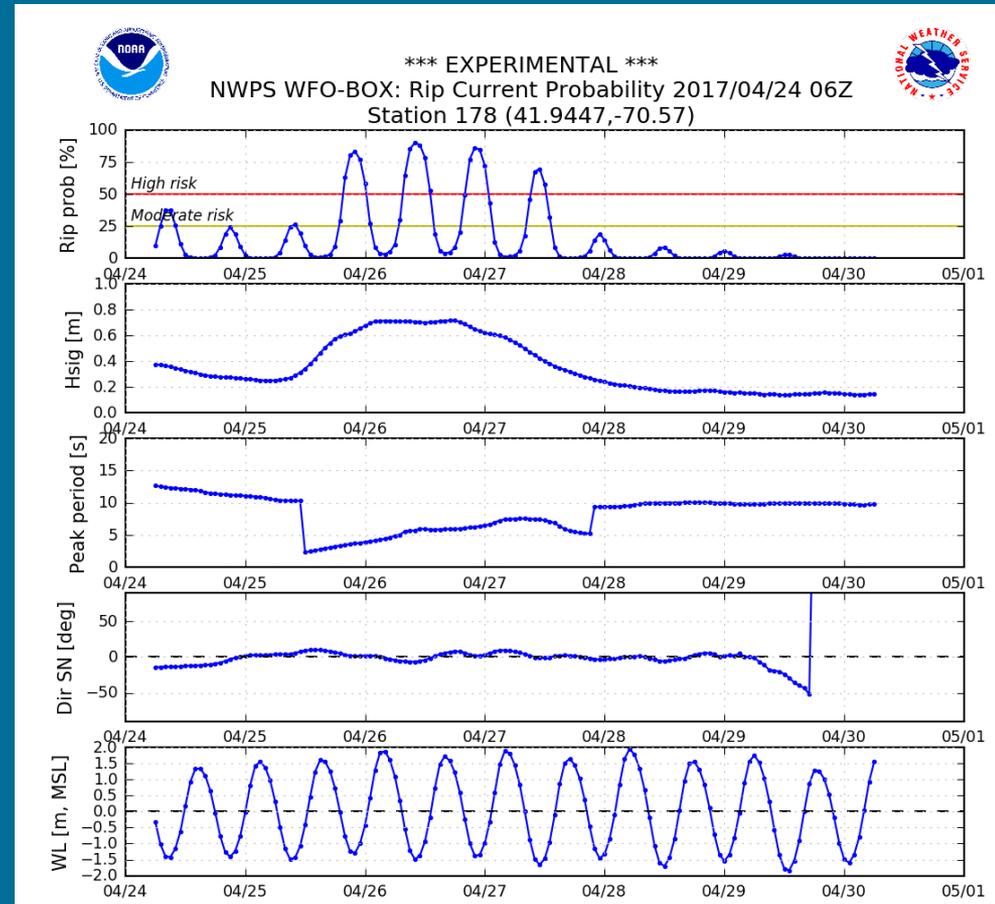
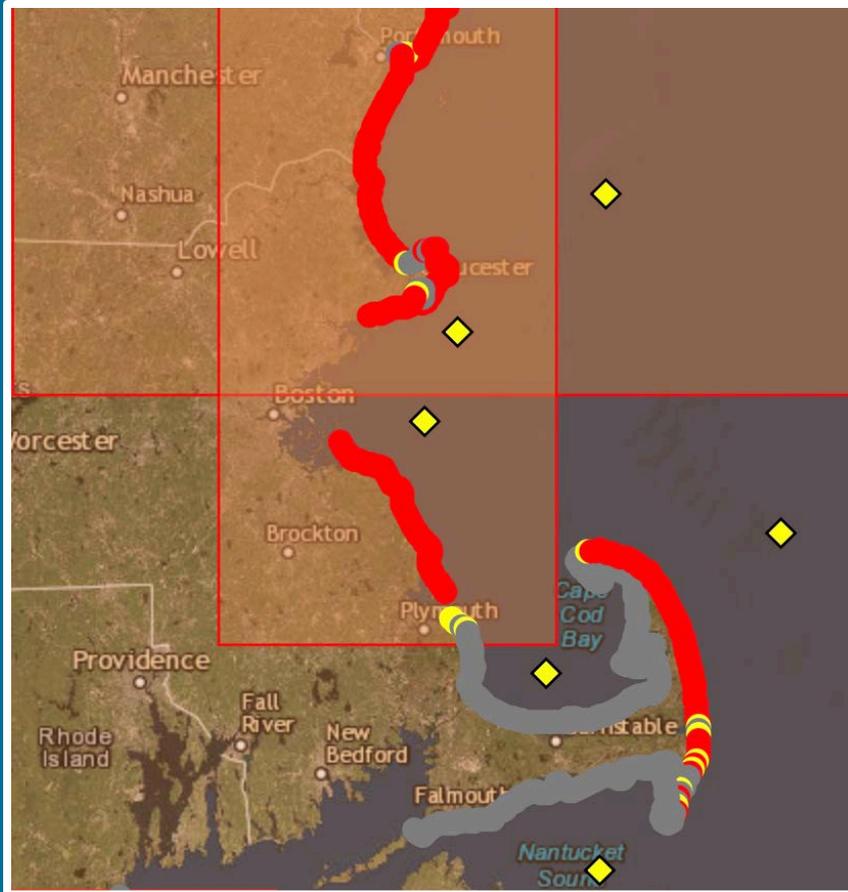




Experimental rip current guidance

Example WFO Taunton

Based on Dusek & Seim (2013)



<http://polar.ncep.noaa.gov/nwps/para/viewer.shtml>

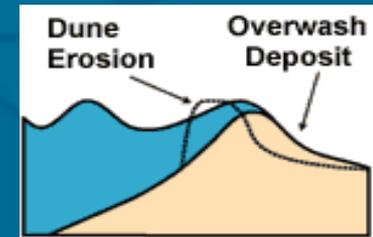
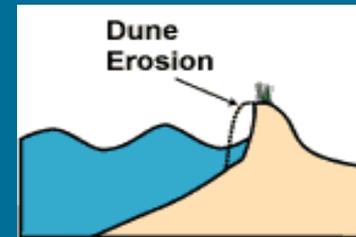
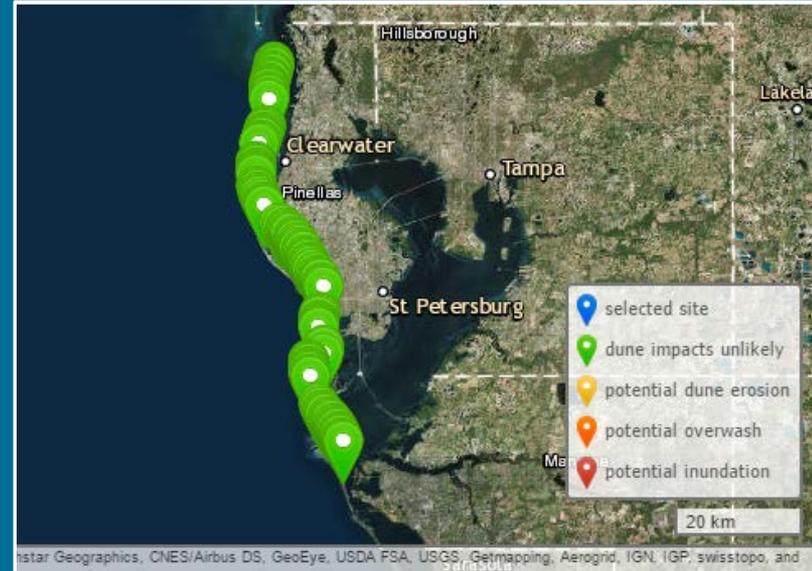
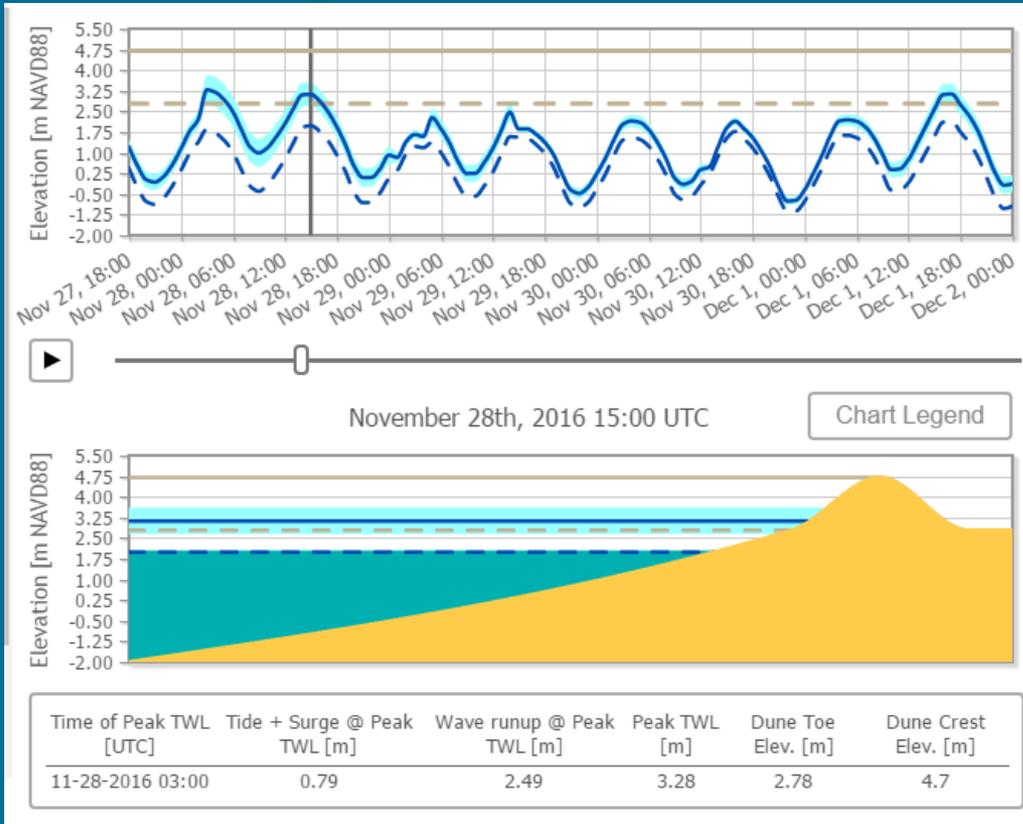




Experimental erosion/overwash guidance

Example WFO Tampa

Based on Stockdon et al. (2006)



<https://coastal.er.usgs.gov/hurricanes/research/twlviewer/>



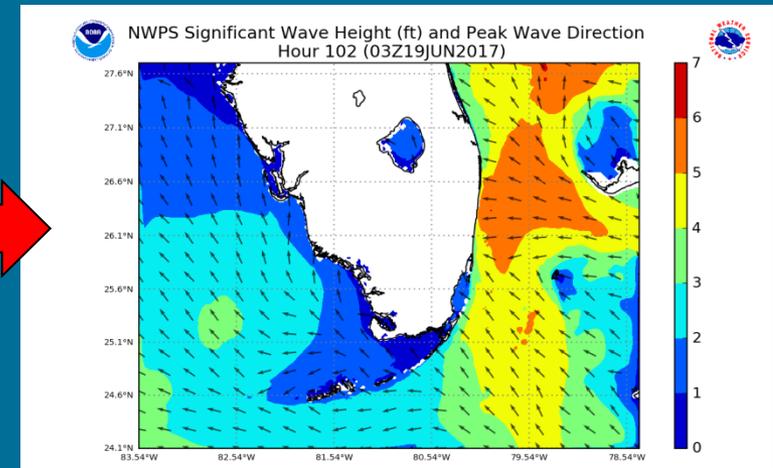
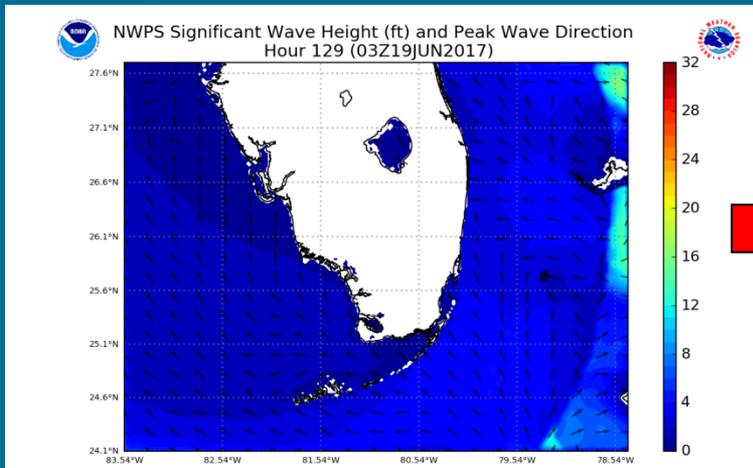
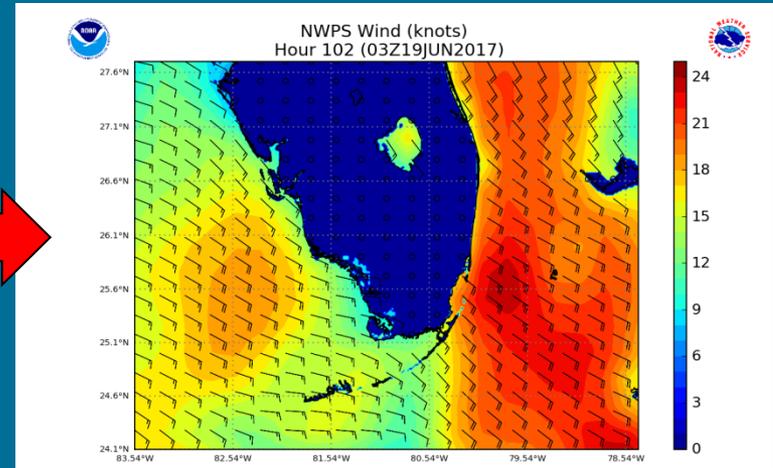
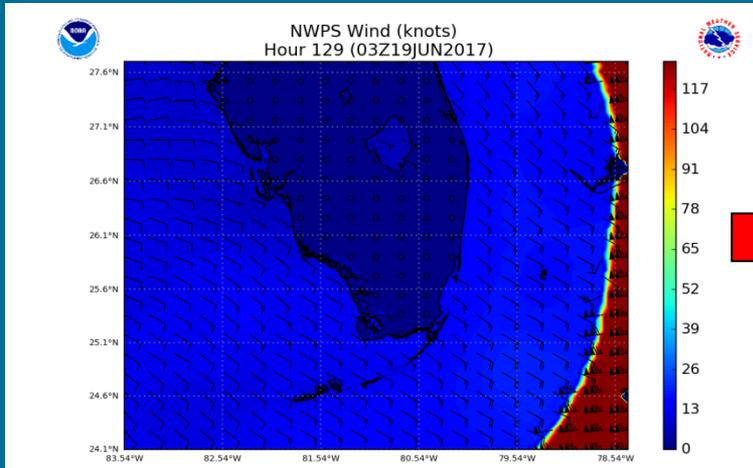


GFS fail-over, in case of bad GFE input

Example WFO Miami

Bad GFE forecaster wind file

Fail-over GFS wind file





Resource changes

Compute

- On-demand runs: Increase from **18 nodes** to **36 nodes** (reserved, exclusive) for extended forecasts/unstructured domains. Falls with natural model growth curve (no HPCRAC).
- OFS prep step: Potentially increase compute cores to accommodate longer P-Surge run output (78h to 102h).

SBN Dataflow

- Data volume will increase from total 4GB per day (peak load 0.55 GB) to 16.6 GB (peak load of 2.3 GB). RC under review.

HPSS archiving

- 16.6 GB/day in HPSS 2-year (increase from 4 GB/day);
- 64 GB/day in HPSS 2-year for retrospectives (increase from 0 GB)



Timing of jobs (1)

National Weather Service
NCEP Central Operations

Home News Organization

DOC NOAA NWS | NCEP Centers: AWC CPC EMC NCO NHC OPC SPC SWPC WPC

Nearshore Wave Prediction System WFO Status

Quick Find:

Clear All Filters

WFO ID	Start Time	End Time	Region	Status	Job Running	Run Info
Select	Select...	Select				
MFL	1802		SR	ACTIVE	FORECAST_CG1	click
MLB	1801		SR	ACTIVE	FORECAST_CG1	click
JAX	1751		SR	ACTIVE	POST_CG1	click
TBW	1731		SR	ACTIVE	POST_CG1	click
AKQ	0743	0826	ER	DONE		click
BOX	0601	0722	ER	DONE		click
BRO	1311	1345	SR	DONE		click
CAR	1258	1357	ER	DONE		click
CHS	1017	1103	ER	DONE		
CRP	1544	1620	SR	DONE		
GYX	1402	1508	ER	DONE		
HGX	0931	1035	SR	DONE		
ILM	1601	1632	ER	DONE		
KEY	1539	1708	SR	DONE		
LCH	0723	0813	SR	DONE		
LIX	0742	0856	SR	DONE		
LWX	1642	1700	ER	DONE		
MOB	0731	0905	SR	DONE		
OKX	0636	0747	ER	DONE		
PHI	0704	0752	ER	DONE		click
SJU	0747	0928	SR	DONE		click
TAE	1631	1757	SR	DONE		click

NOAA National Weather Service
National Centers for Environmental Prediction
5830 University Research Court
College Park, MD 20740
NCEP Internet Services Team

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NWPS run started on Thu Dec 3 17:59:34 UTC 2015
MFL wind file: 201512031756_WIND.txt
Run was configured with forecaster settings
Run settings: RUNLEN=102 WNA=WNAWave NESTS=Yes RTOFS=Yes
WINDS=FORECASTER WEB=Yes PLOT=Yes USERDELTA=600
HOTSTART=TRUE WATERLEVELS=ESTOFS MODELCORE=SWAN
Forecast analysis time: 20151203 18Z

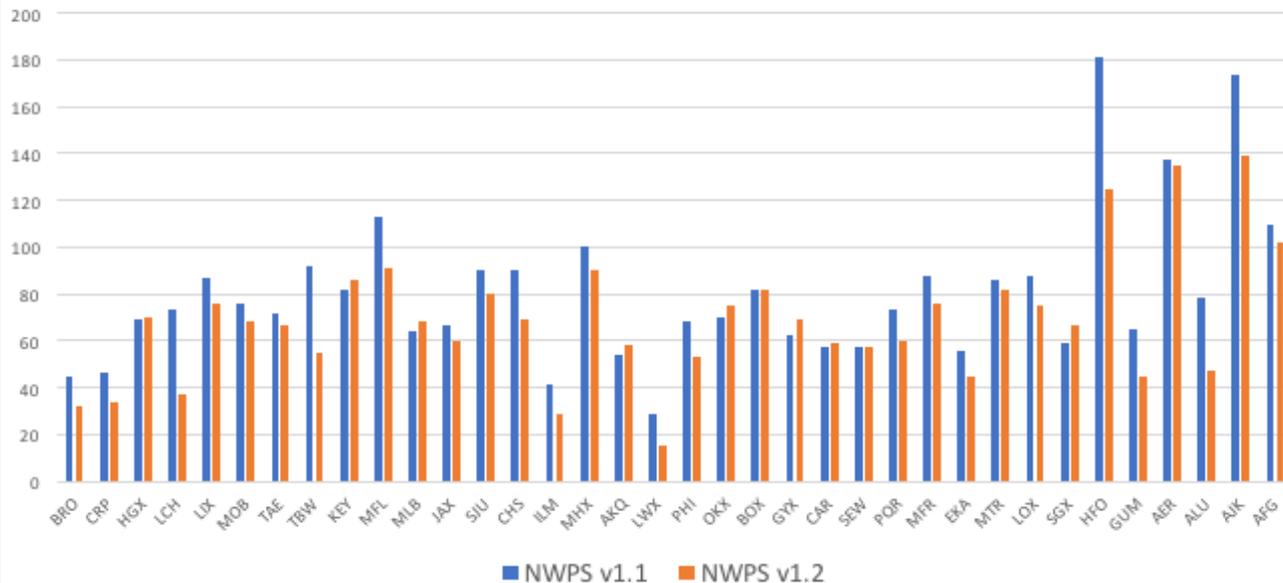




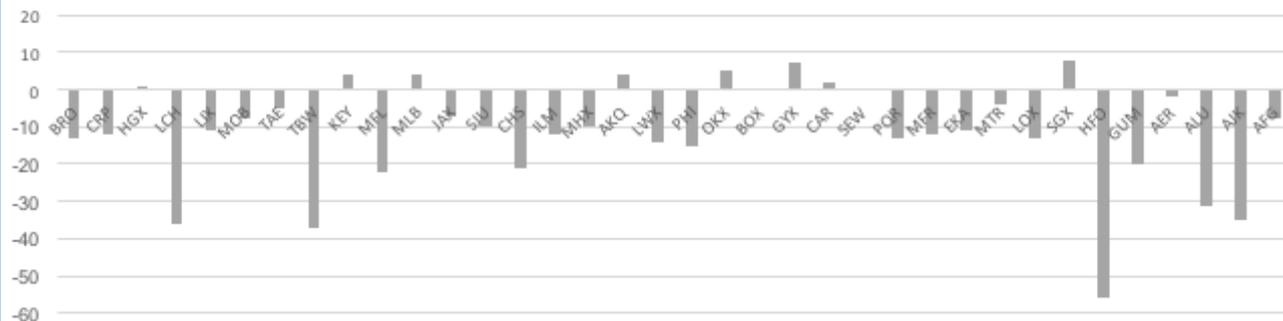
Timing of jobs (2)

Mostly
reduction in
turn-around
time

Run Time Comparison (minutes)



Run Time Difference (v1.2 - v1.1, in minutes)



Issues:

GYX: +8 min

SGX: +8 min





Data input/output additions

Inputs

- New dependency on GFS (pgrb files) for fail-over option.

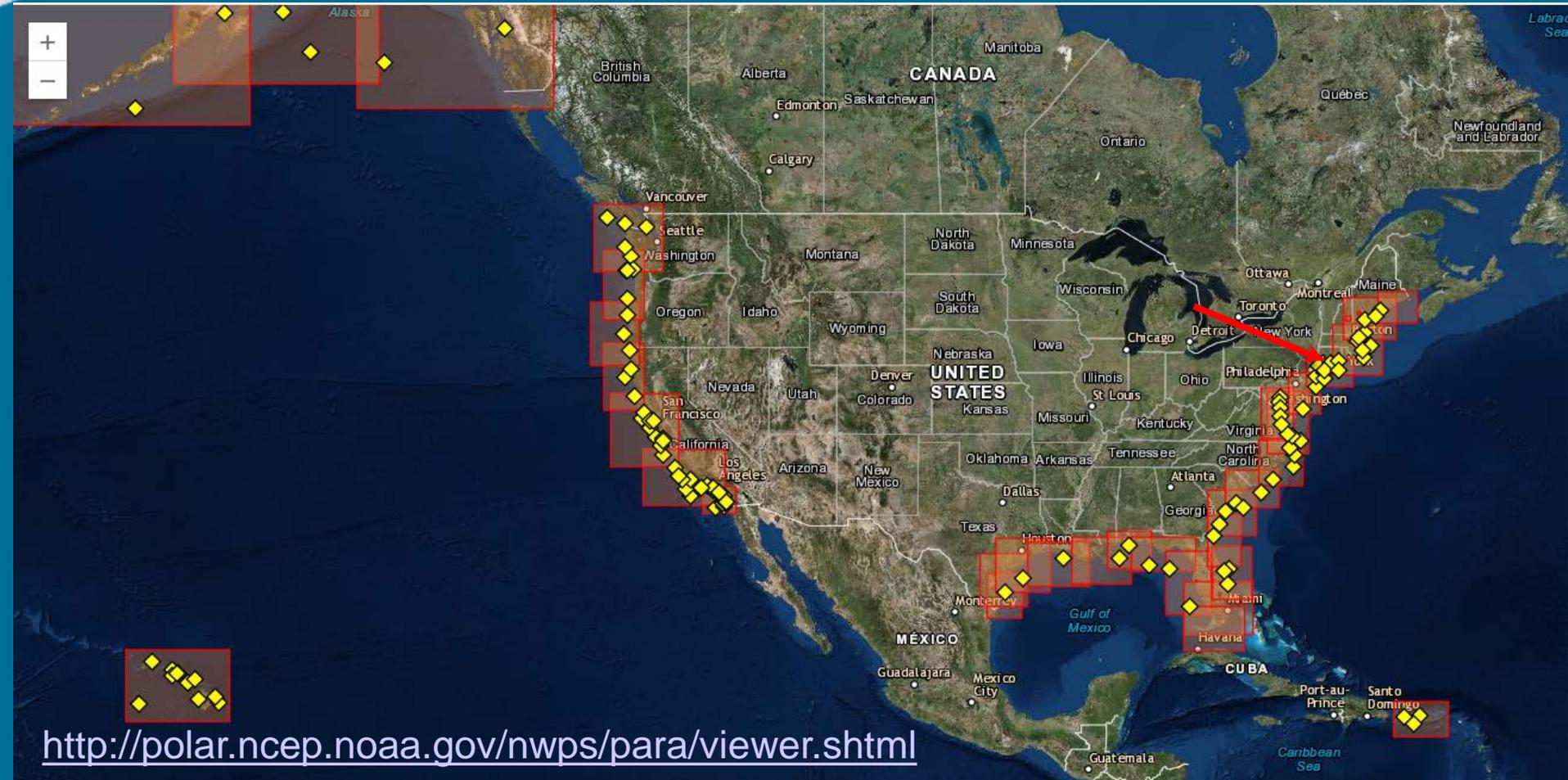
Outputs

- WMO headers appended to accommodate extended forecast time/hourly output fields.
- NOTE: Experimental rip current and erosion/overwash fields will not be transmitted over the SBN (for validation purposes only).



Validation results

NDBC buoys: 2017/01/01-2017/06/15



<http://polar.ncep.noaa.gov/nwps/para/viewer.shtml>

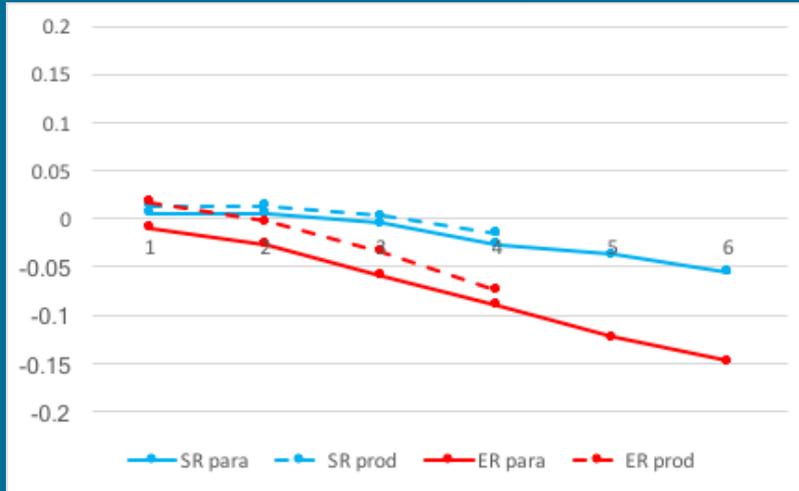




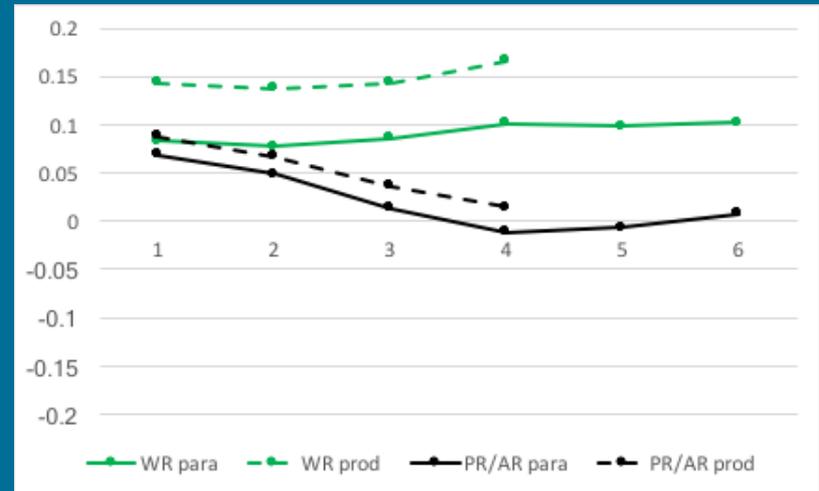
Validation results

NDBC buoys: 2017/01/01-2017/06/15

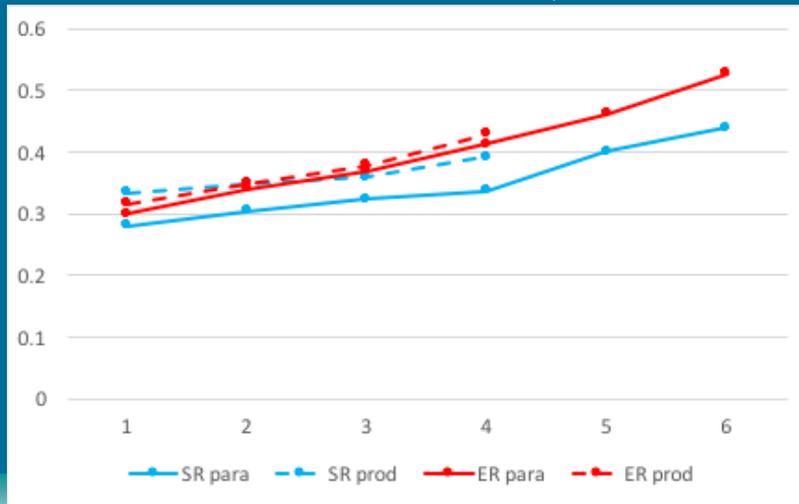
Rel. Bias: SR, ER



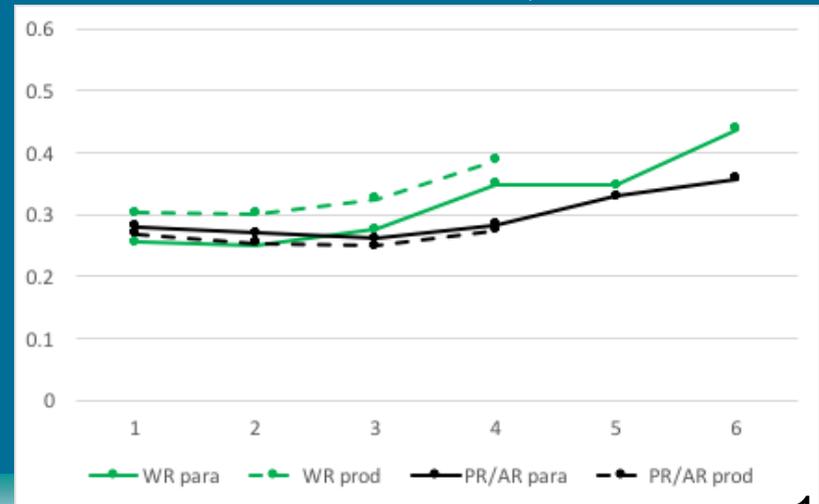
Rel. Bias: WR, PR/AR



Scatter Index: SR, ER



Scatter Index: WR, PR/AR





User evaluation

- Southern Region: Implement as proposed ✓
- Eastern Region: Implement as proposed ✓
- Western Region: Implement as proposed ✓*
- Pacific Region: Implement as proposed ✓
- Alaska Region: **Restart issue** ✗



User evaluation

- **Southern Region: WFO Miami** (Pablo Santos)
- Eastern Region: WFOs Caribou & Upton (Tony Mignone, Nelson Vaz, Brian Miretzky)
- Western Region: WFO San Diego (Jeff Lorens, Drew Peterson)
- Pacific Region: WFO Tiyan, Guam (Paul Stanko)
- Alaska Region: WFO Anchorage (Emily Niebuhr)





Southern Region NWPS v1.2 Evaluation

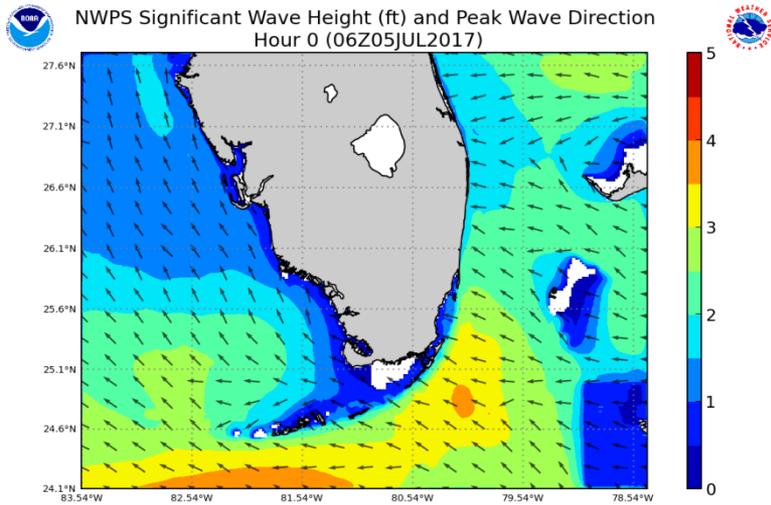
Pablo Santos
MIC, WFO Miami, FL

WFO MFL: Evaluation Remarks

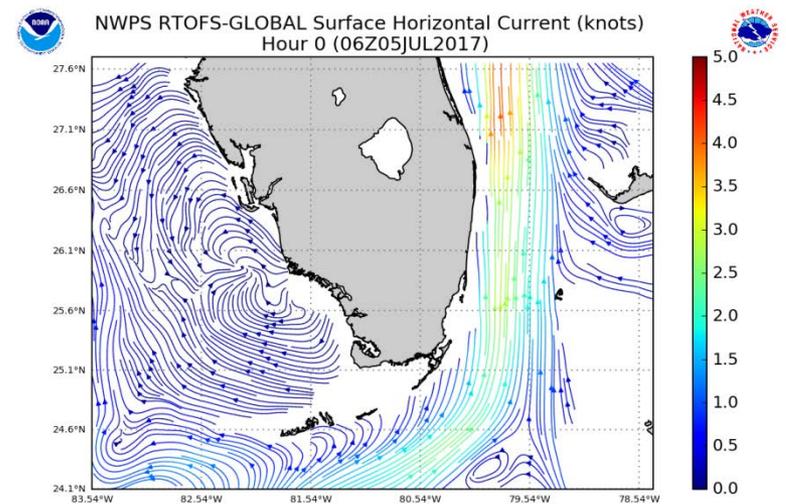
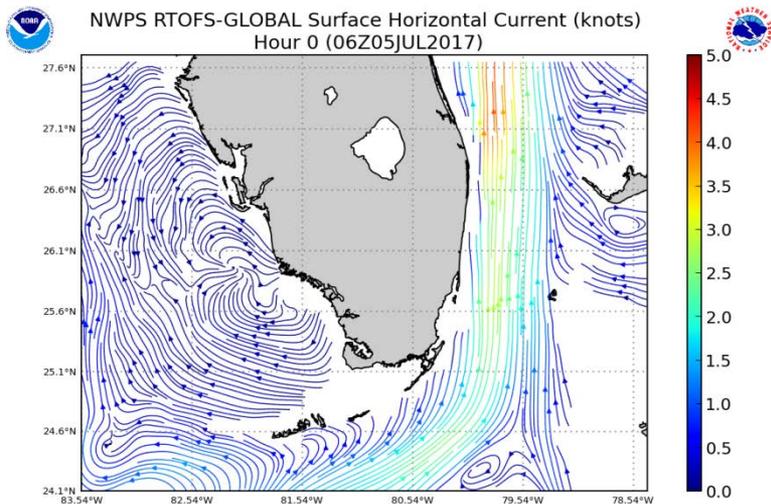
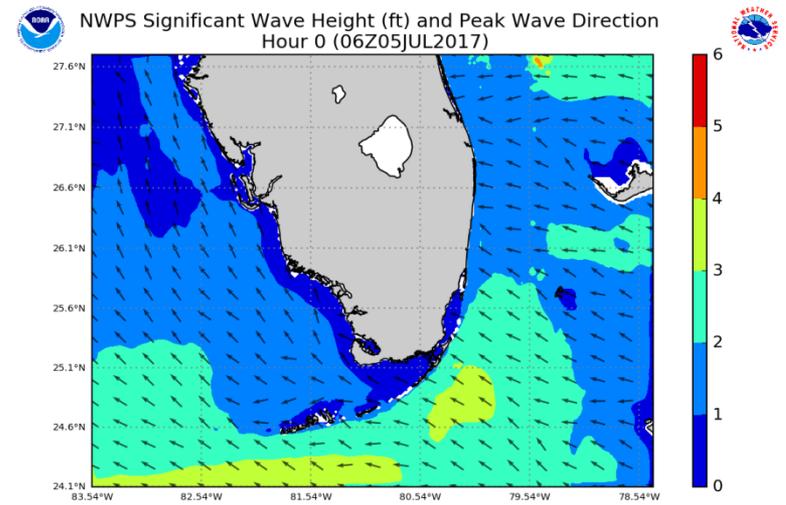
- Parallel output very similar to Production with the inclusion of the Gulf Stream data. Slight differences, but expected given the simulation domain is now on an unstructured mesh.
- Confirmed that the Gulf Stream data itself looks nearly identical in Parallel and Production.
- Experimental rip current output very similar in Parallel and Production. Some differences in time series, but understandable considering the sensitivity of rip algorithm to nearshore wave direction.
- However, there appears to be a problem with the rip current spatial plotting scripts – rip risk shown as “high”, which does not change in time. ISSUE CORRECTED
- New CG2-CG5 high-res nested domains look really good, as well as output of basic fields. Maps are slightly better in Parallel than Production. Overwash and Dune Erosion maps look good but will be hard to test until we have an actual event.
- New Lake Okeechobee domain (relocated CG3 nest) looks good. Will be hard to validate goodness of output until we include variable lake level data in next upgrade (out of scope current implementation).
- **Definitely ok with going into production with unstructured mesh NWPS v1.2**

WFO MFL: Evaluation Remarks (2)

Production

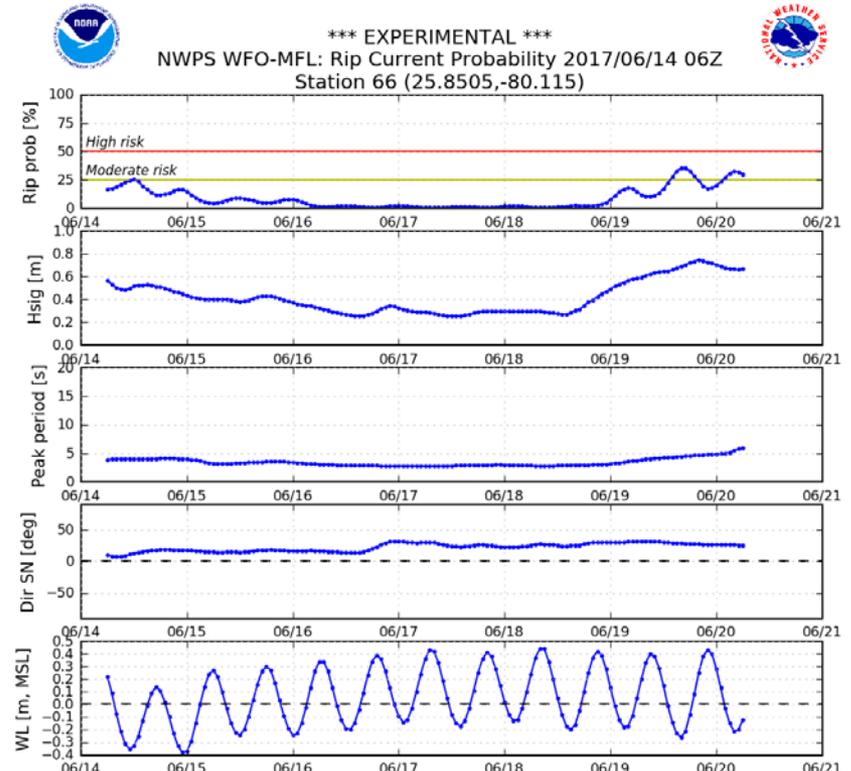
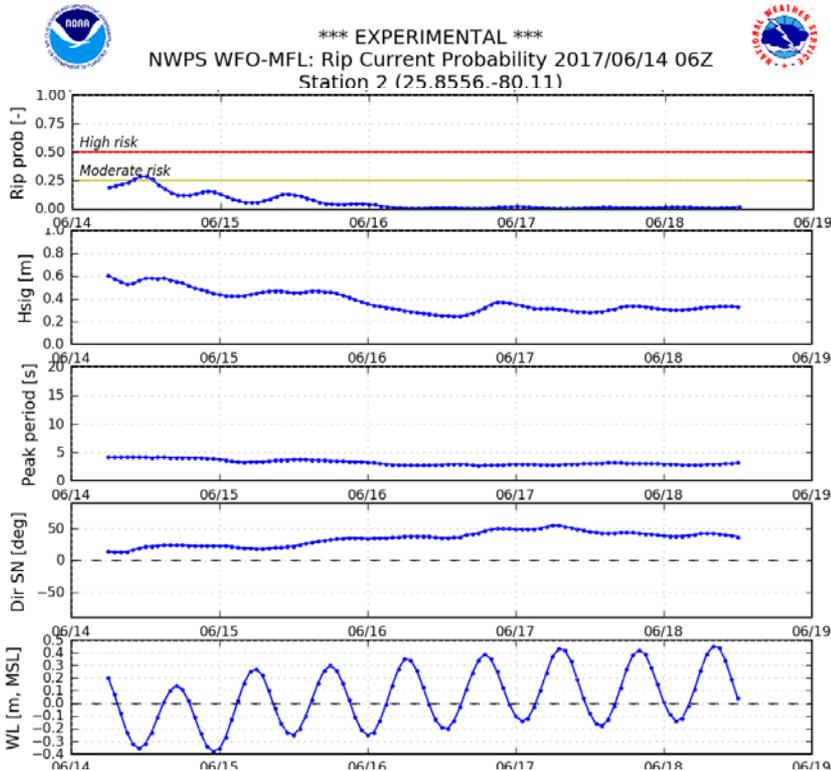
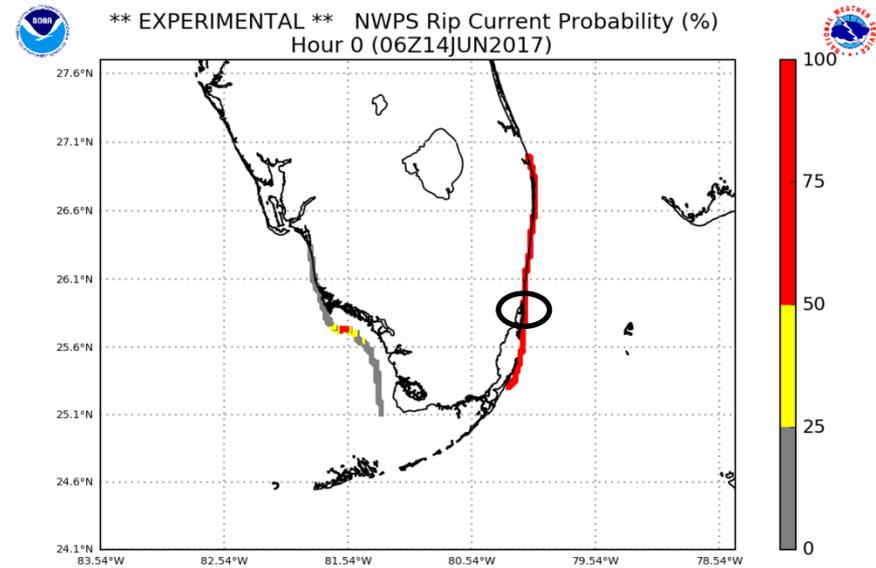


Parallel



WFO MFL: Evaluation Remarks (3)

Rip current risk shown as “high” (red) in spatial plot above, whereas only “moderate” in time series below. ISSUE CORRECTED





User evaluation

- Southern Region: WFO Miami (Pablo Santos)
- **Eastern Region: WFOs Caribou & Upton** (Tony Mignone, Nelson Vaz, Brian Miretzky)
- Western Region: WFO San Diego (Jeff Lorens, Drew Peterson)
- Pacific Region: WFO Tiyan, Guam (Paul Stanko)
- Alaska Region: WFO Anchorage (Emily Niebuhr)

Model Implementation Subjective Evaluation Report

Scientific Review Team Member: ___ Brian Miretzky/ Jeff Waldstreicher ___

Region/Service Center/Company Representing: ___ Eastern Region ___

Proposed Change: NWPS v1.2

Project Manager: Andre van der Westhuysen (NCEP/EMC) / Dennis Atkinson (OSTI)

Real-Time Parallel Runs:

General comments: ___ The upgrade is beneficial in many ways. We support moving forward toward implementation. ___

Evaluation of expected benefits:

Please respond to the following questions and note if they are beneficial to you

1. Is the extension of the forecast guidance out to 144h useful to your organization? Does it show skill?

___ Yes! And from what we have seen it shows skill as well so it will be used. ___

2. Does the hourly output interval of the guidance provide sufficient temporal resolution with which to compile marine forecasts?

___ Yes it helps reduce the interpolation needed, and this is especially important in areas of large tidal ranges. ___

3. (For 10 unstructured domains only.) Has the increased coastal resolution in the model (albeit interpolated onto existing AWIPS grids) improved the quality of nearshore wave fields?

___ Yes, while this was hard to evaluate on its own the improved resolution allows for areas not previously seen to be observed. Some of this benefit may be lost when scaled to 2.5 km in GFE

so we need to consider if there is anything that can be done to mitigate the upscaling effects.

4. (For 10 unstructured domains only.) Are the extent and resolution of rip current output points sufficient? Does this rip current output have the potential to be a useful coastal hazard guidance, following sufficient validation?

Yes and yes, although additional validation will be done during the rip current season. Can you provide the model equations used for the rip current output? Is it directly from Dusek's work? _____

5. (For 10 unstructured domains only.) Are the extent and resolution of runup (erosion/overwash) output points sufficient? Do you consider this erosion/overwash output to be a useful future guidance source, following sufficient validation?

Yes in some cases, but could possibly use other points in some locations. Feedback from OKX suggested more points along the north shore of LI and coastal CT so that it was similar to the rip current locations. The output is useful and will be validated as events occur. So far limited validation shows utility. _____

Recommendation:

Implement as proposed ___X___

Reevaluate after changes ___

Do not implement ___



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NWPS v1.2 EVALUATION

Steve Harrison

WFO San Diego, CA

Jeff Lorens

NWS/Western Region HQ

Real Time Parallel Runs

- Rip Current Risk has “High” for full duration (144 hrs), even during periods of reduced surf
- Wave data is less “noisy” (good)
- High bias in waves (from local winds) is less apparent compared to previous version

Expected benefits

- Extension to 144 hrs is very beneficial – better supports Coastal Waters Forecast 5-day requirement
- Wave shadowing in Channel Islands area looks good
- Main benefit of hourly data: rip currents?
 - For deep water, 3 hrly data is sufficient
- Nearshore waves appear to be improved (e.g. refraction in shallow waters)

Rip Current Guidance

- Extent & temporal resolution of output points is sufficient
- Guidance is potentially useful, but there is a definite high bias
 - Rip currents are always present in S. CA due to persistent surf, but trends are not apparent when risk is always “high”
- Runup guidance: N/A (for WR)

Summary

- Extension to 144 hrs – very positive
- Rip current high bias makes guidance less useable
- Wave partitioning & tracking remains an issue; increases forecaster workload in complex wave environments (typical for west coast WFOs)
- Recommendation: Implement NWPS v1.2
 - Develop/implement solution for partitioning & tracking



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Stn 197 Waves

Hmax

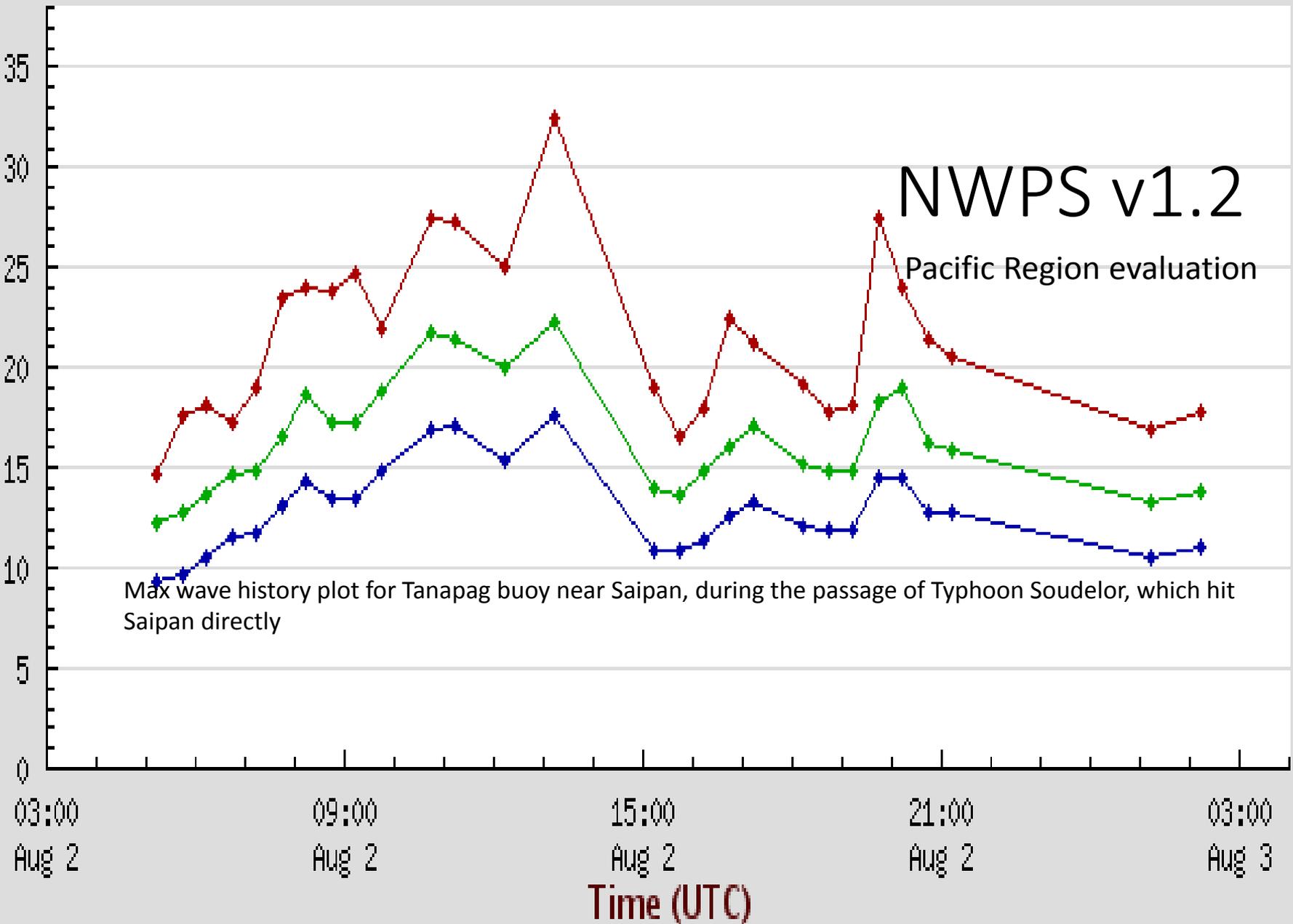
Htenth

Hthird

Wave height (ft)

NWPS v1.2
Pacific Region evaluation

Max wave history plot for Tanapag buoy near Saipan, during the passage of Typhoon Soudelor, which hit Saipan directly



How do NWPS resolution & fidelity compare with WW3?

GlobalWave cannot even resolve the island of Rota

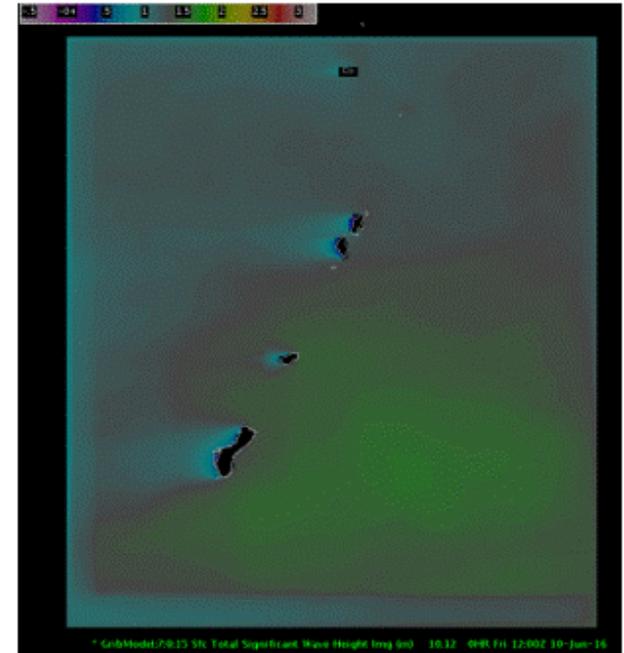
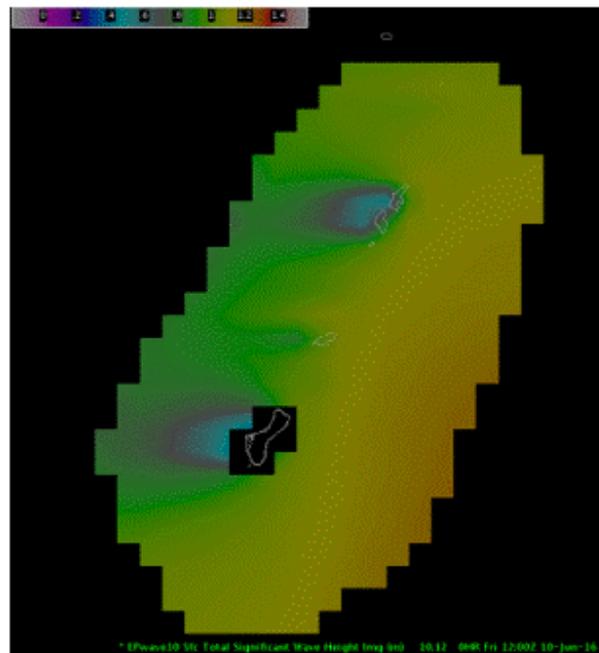
EPwave10 can resolve Rota, but not the separation between Tinian and Saipan. Also, see how blocky the Guam exclusion is?

NWPS can not only resolve Rota and the separation between Tinian and Saipan, also Anatahan, and see how much smoother the coasts are? This will allow better surf forecasts in the future.

**WW3_Multi1 GlobalWave:
0.5 degrees (55 km)**

**WW3_Mult1 EPwave10:
10 arc-min (19 km)**

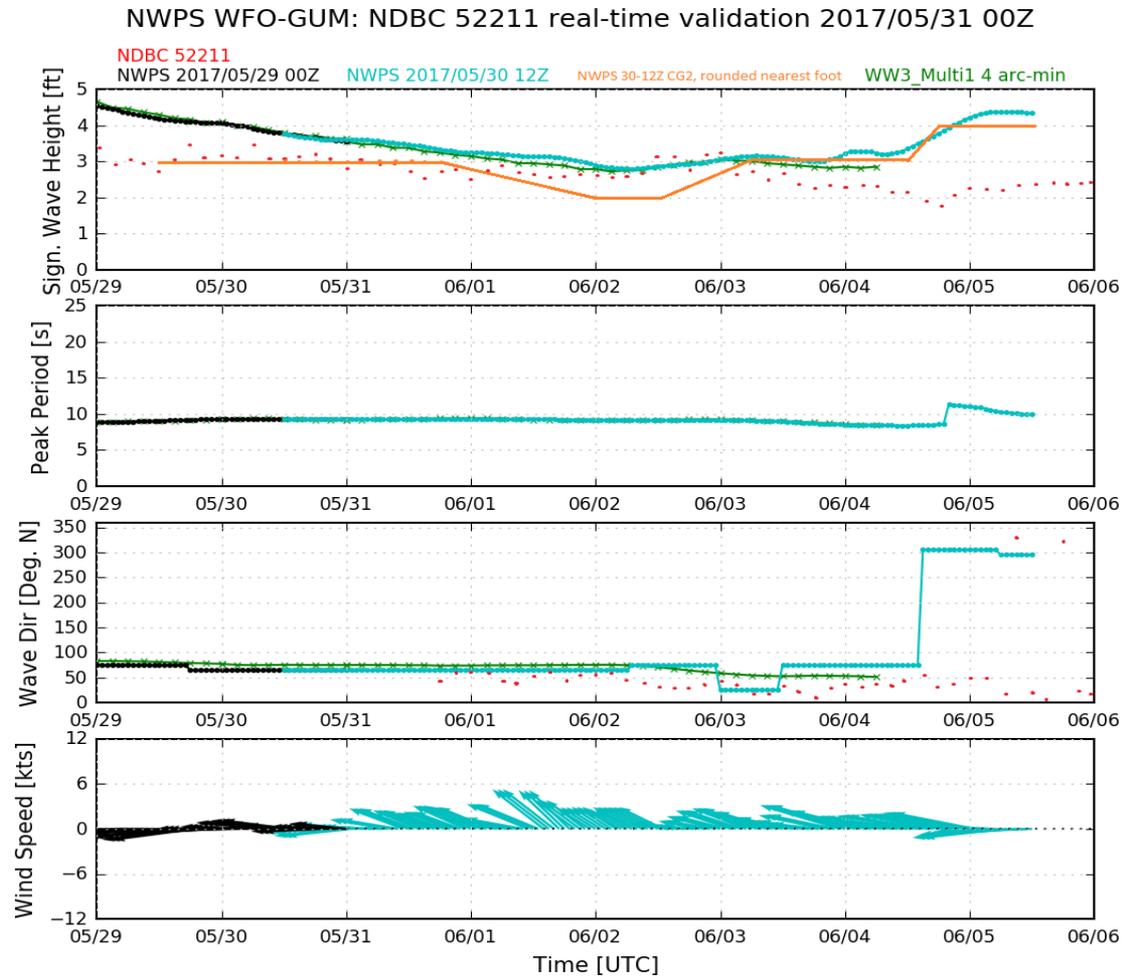
**NWPCG1 2 arc-min (4km) and
NWPS CG2/3/4 30 arc-sec (1 km)**



Why does Pacific Region recommend implementation?

In the top graph, the red dots represent buoy heights every 3 hours. WW3 Multi1 overforecast the wave heights, as did the NWPS CG1 grid. However, the CG2 grid in orange did much better. Our complicated island coastlines need this high resolution data.

In the 3rd graph, we see NWPS forecasting a northwest swell in June, very rare here in the tropical West Pacific at this time of year. The red dots show the buoy direction every 3 hours, and while you can see it was not as dramatic as NWPS predicted, it was in fact there, and we knew 6 days in advance.

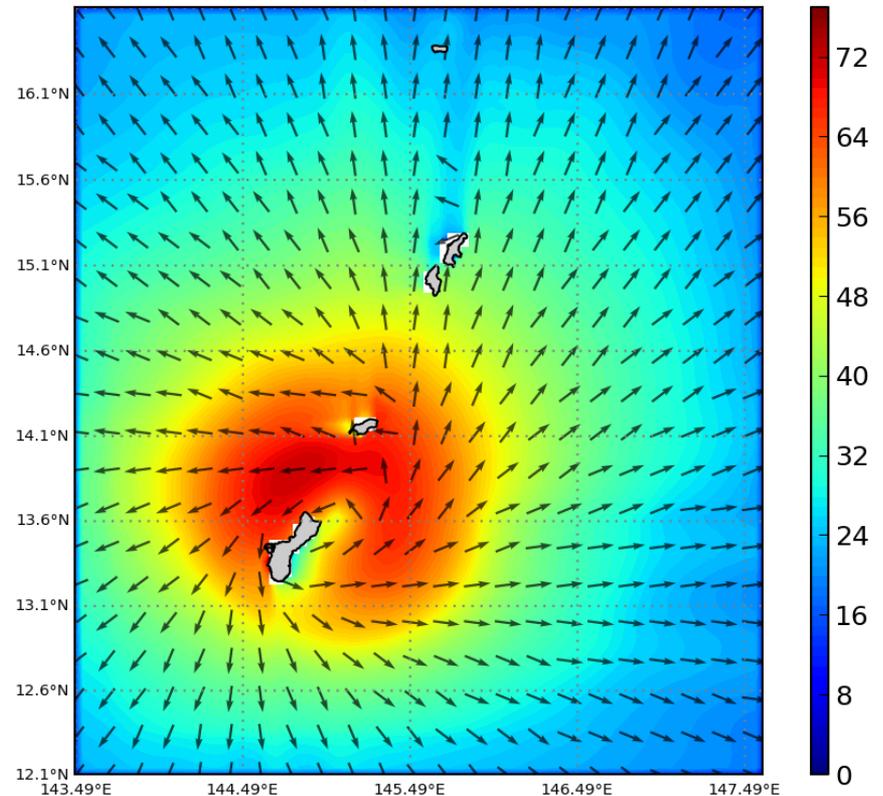


Effects on Tropical Cyclone services

Please note, this was just a simulation Andre and I performed, this was not a real event. In case of a real event, though, we could have up to 6 days advance notice, hourly wave model data and high resolution shadowing, which you can see in the image to the right. Soon, we will have ESTOFS water level data also, which will add to the benefits. We will be able to better diagnose surf hazards related to tropical cyclones, and when the new rip current and overwash guidance is available for the Marianas, the improvements will once again be astounding. We will also soon, probably next calendar year, add domains for Micronesia.



NWPS Significant Wave Height (ft) and Peak Wave Direction
Hour 81 (03Z07MAY2016)





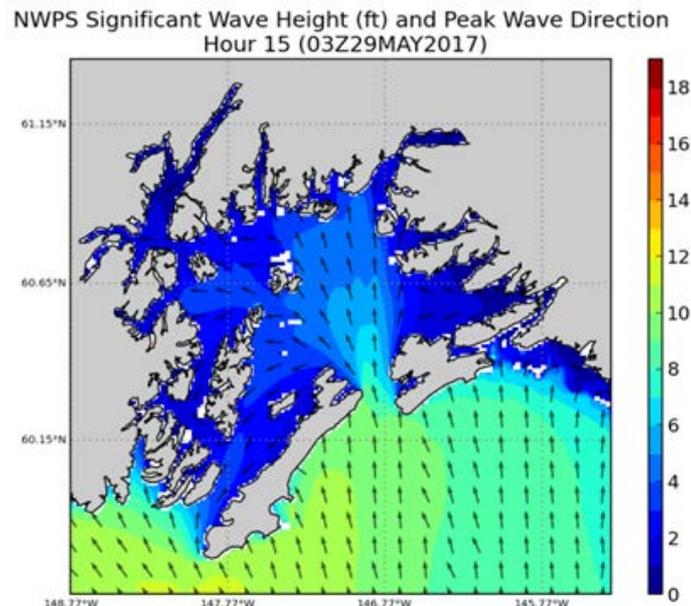
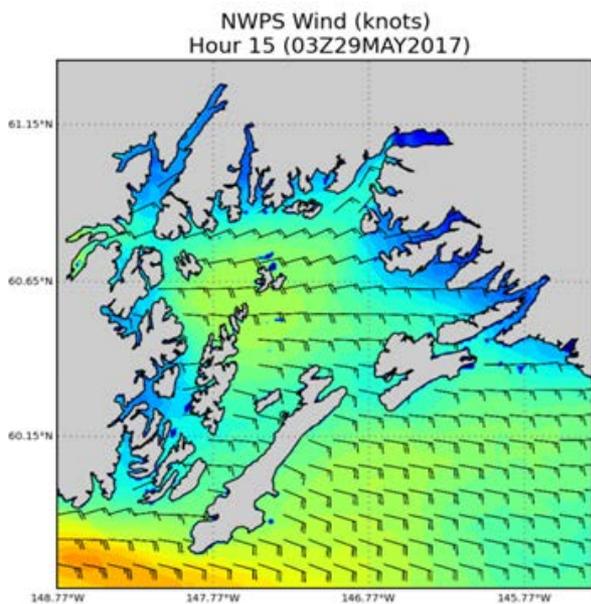
User evaluation

- Southern Region: WFO Miami (Pablo Santos)
- Eastern Region: WFOs Caribou & Upton (Tony Mignone, Nelson Vaz, Brian Miretzky)
- Western Region: WFO San Diego (Jeff Lorens, Drew Peterson)
- Pacific Region: WFO Tiyan, Guam (Paul Stanko)
- **Alaska Region: WFO Anchorage (Emily Niebuhr)**



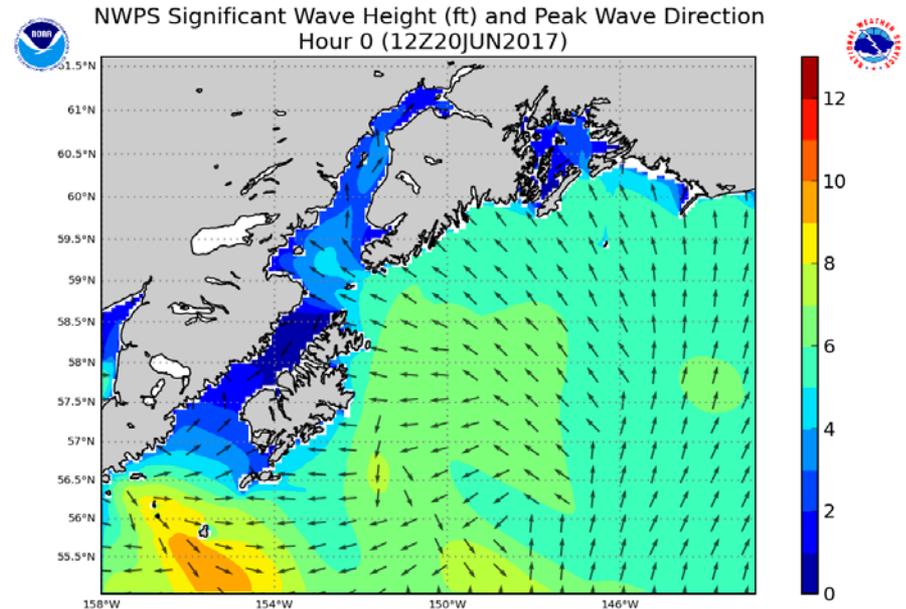
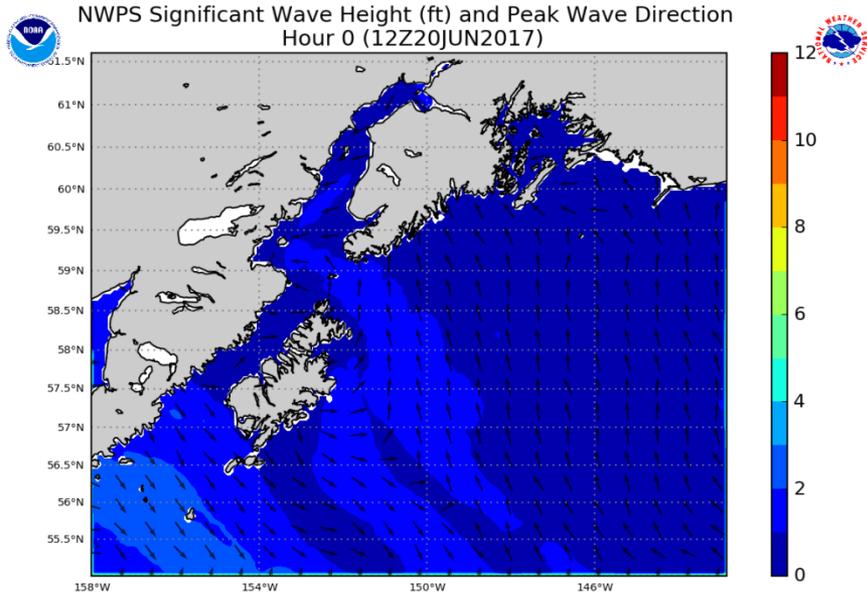
Value of NWPS: One Example

- Customer was taking shelter from some gusty winds up to 25 mph and waves up to 4 feet.
- NWPS high resolution wave heights and high resolution maps allowed forecasters to guide boater to avoid waves that were dangerous
- Called back next day to say forecast was 100% correct and caught fish



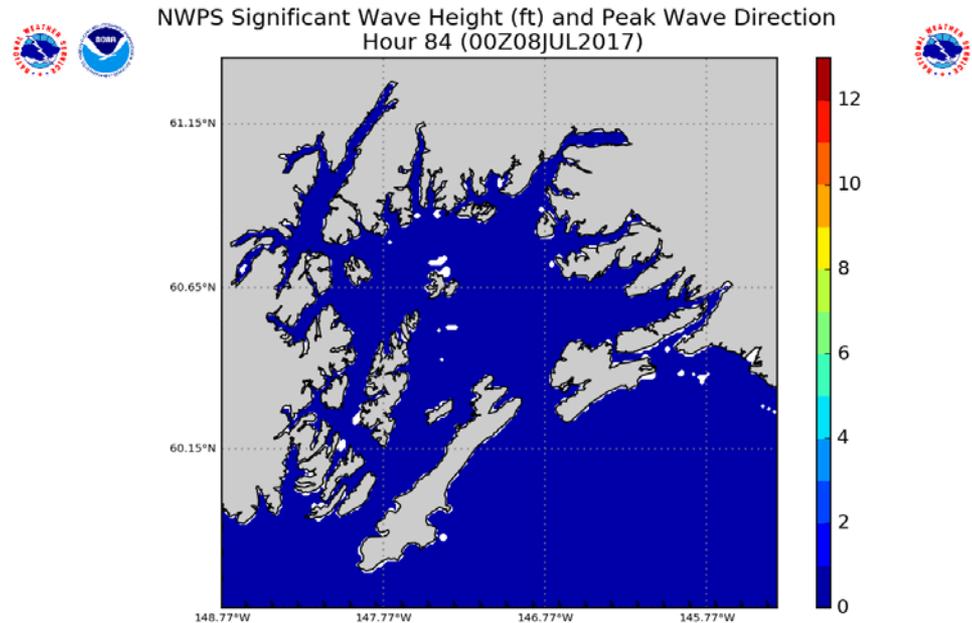
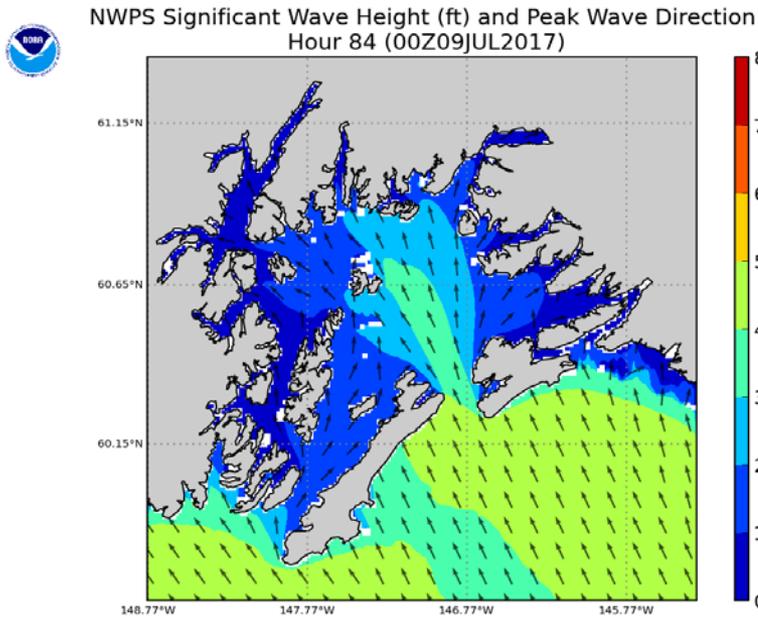
Initialization Errors

- Several times the initial plot for the 1.2 has shown values near zero at initialization.



Sometimes Missing Data

- AER CG3 today data stopped at hour 84– only CG3 grid effected this time, rest of AER CG1 and CG2 ok



Alaska faces many unique challenges for wave forecasting due to steep bathymetry, some of the greatest tidal fluctuations in the nation, and most intense weather systems in the country, with some low pressure systems reaching 940mb and accompanied by 100 mph wind gusts. As this study occurred during a summer month, it does not reflect the most extreme wave and weather conditions experienced by mariners in Alaska. However, this study does occur during the active tourism season during which a forecast difference of 1 or 2 ft can determine whether or not a boat is able to complete a fishing tour. As a result, the wave height forecast has direct implications for local tourist business owners and many small communities in Alaska where fishing or tourism are the main sources of income.

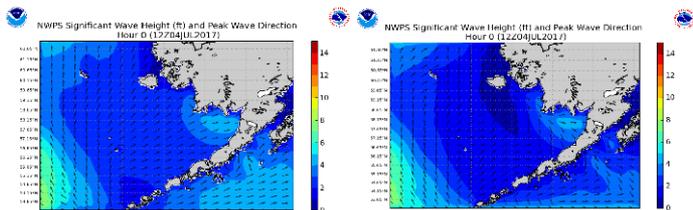
Hourly Wave Data: As there has been no request from customers to have hourly data, if possible it may be best just to stay with 3 hourly data due to the computational constraints of covering such a large domain. Is there an estimation to how much time this adds to the runtime of the model?

Length in Runs: A longer time for the model could certainly benefit customers. However, due to the high synoptic variability in Alaska, and model uncertainty I think it will be likely that Alaska will have one of the worst verification statistics for the 120 and 144 hour plots. **Model Unreliability:** With few observations available across the Bering and north Pacific the model data used to help drive the wind forecast inputs often vary dramatically from run to run, especially towards 144 hours. **Weather Variability:** Weather systems tend to show much stronger variability than in other states, with potent fronts and lows to 930 mb. Even small changes in the forecast can result in dramatically different wind and wave situations, especially in coastal areas where winds are enhanced orographically.

Unstructured Grid: Due to the dramatic change in bathymetry, Alaska, particularly Southcentral, would be a prime candidate to take advantage of this. We would like to be included in the next upgrade.

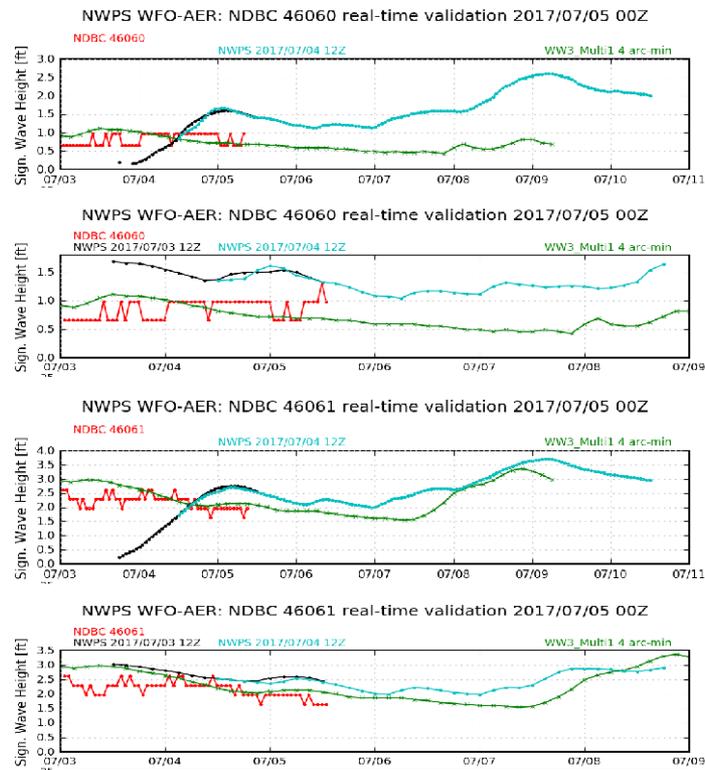
Errors:

Initial conditions: There still seems to be something wrong with the initialization of the new model 1.2. Frequently there will be very different start images. Here is one example from today. The image on the right is version 1.2



In addition, the forecast plot still often shows the entire model from initialization (from height 0) which will likely confuse the customer etc. Finally, in some instances, it appears that the NWPS model now indicates higher waves than the original. The source of this increase is not clear, but in some cases is up to 1 foot, which for buoy 46060 has big implications.

The sources of these errors is a bit puzzling if the main upgrades were to change to hourly winds and to extend the model time, as I am not sure how this would impact magnitude or initialization, but these are common problems. Perhaps there is a minor error in the code somewhere for Alaska?

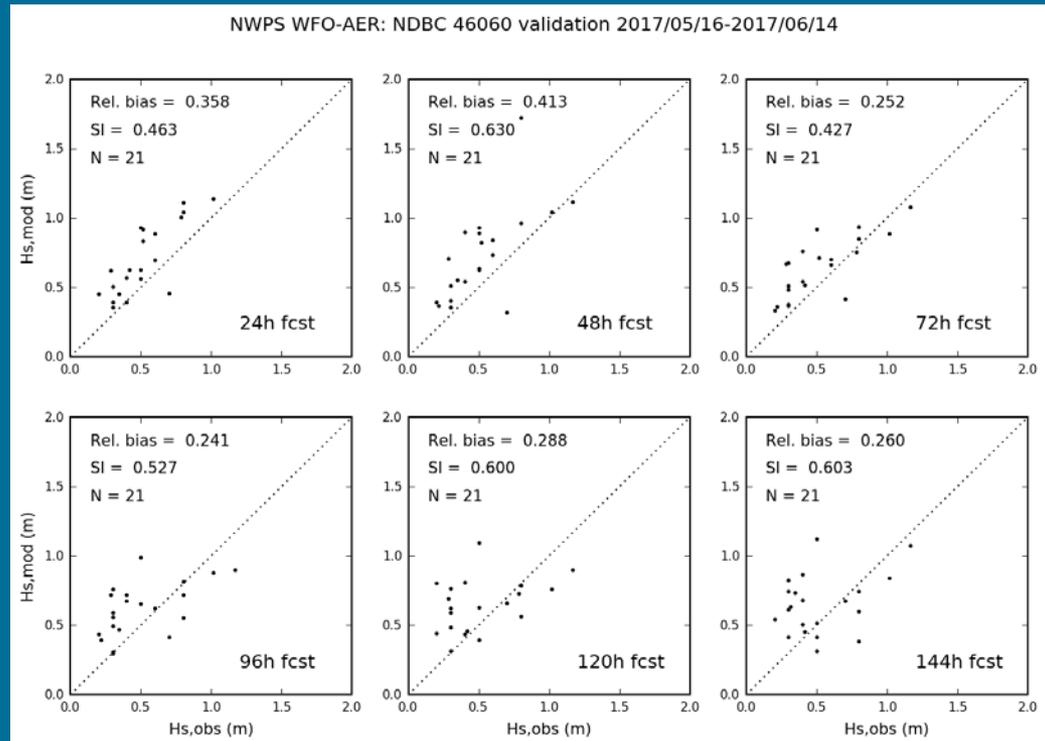
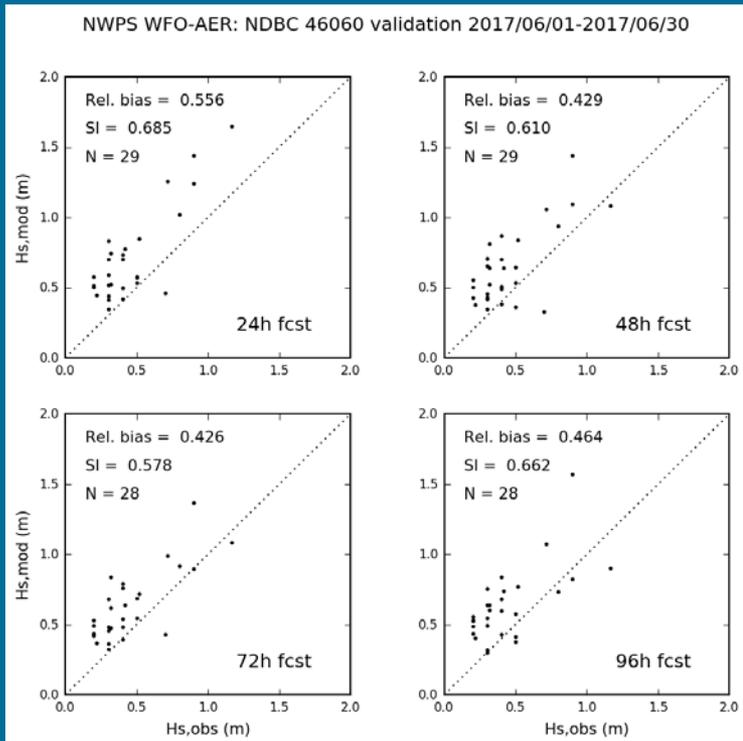




WFO Anchorage validation results

NDBC 46060 (West Orca Bay, Prince William Sound)

- Comment: "In some instances, it appears that the NWPS model now indicates higher waves than the original"





USER EVALUATION REPORTS



Model Implementation Subjective Evaluation Report

Scientific Review Team Member: ___ Brian Miretzky/ Jeff Waldstreicher ___

Region/Service Center/Company Representing: ___ Eastern Region ___

Proposed Change: NWPS v1.2

Project Manager: Andre van der Westhuysen (NCEP/EMC) / Dennis Atkinson (OSTI)

Real-Time Parallel Runs:

General comments: ___ The upgrade is beneficial in many ways. We support moving forward toward implementation. ___

Evaluation of expected benefits:

Please respond to the following questions and note if they are beneficial to you

1. Is the extension of the forecast guidance out to 144h useful to your organization? Does it show skill?

___ Yes! And from what we have seen it shows skill as well so it will be used. ___

2. Does the hourly output interval of the guidance provide sufficient temporal resolution with which to compile marine forecasts?

___ Yes it helps reduce the interpolation needed, and this is especially important in areas of large tidal ranges. ___

3. (For 10 unstructured domains only.) Has the increased coastal resolution in the model (albeit interpolated onto existing AWIPS grids) improved the quality of nearshore wave fields?

___ Yes, while this was hard to evaluate on its own the improved resolution allows for areas not previously seen to be observed. Some of this benefit may be lost when scaled to 2.5 km in GFE

so we need to consider if there is anything that can be done to mitigate the upscaling effects.

4. (For 10 unstructured domains only.) Are the extent and resolution of rip current output points sufficient? Does this rip current output have the potential to be a useful coastal hazard guidance, following sufficient validation?

Yes and yes, although additional validation will be done during the rip current season. Can you provide the model equations used for the rip current output? Is it directly from Dusek's work? _____

5. (For 10 unstructured domains only.) Are the extent and resolution of runup (erosion/overwash) output points sufficient? Do you consider this erosion/overwash output to be a useful future guidance source, following sufficient validation?

Yes in some cases, but could possibly use other points in some locations. Feedback from OKX suggested more points along the north shore of LI and coastal CT so that it was similar to the rip current locations. The output is useful and will be validated as events occur. So far limited validation shows utility. _____

Recommendation:

Implement as proposed ___X___ **Reevaluate after changes** ___
Do not implement ___

Model Implementation Subjective Evaluation Report

Scientific Review Team Member: Stephen Harrison

Region/Service Center/Company Representing: NWS WFO San Diego, CA

Proposed Change: NWPS v1.2

Project Manager: Andre van der Westhuysen (NCEP/EMC) / Dennis Atkinson (OSTI)

Real-Time Parallel Runs:

General comments: The rip current risk guidance has "High Risk" for all 144 hours even during lower than average wave environments.

- Parallel run looks less noisy over deep waters, which is good.
- Waves produced by local winds seem more toned down compared to previous NWPS, which could be good for decreasing the high bias
- Also, I want to mention that WR coastal WFOs really need the wave tracking fixed for NWPS to be useful for forecasters to use.

Evaluation of expected benefits:

Please respond to the following questions and note if they are beneficial to you

1. Is the extension of the forecast guidance out to 144h useful to your organization? Does it show skill?

Yes! Our Coastal Waters Forecast goes out 5 days, so we need wave data out through 144 hours. Also, yes, it shows skill. The wave heights and periods compare well to the Spectral Text Bulletin for buoy 46086 and the shadowing from the channel islands looks good.

2. Does the hourly output interval of the guidance provide sufficient temporal resolution with which to compile marine forecasts?

For deep waters, we only need 3 or 6 hourly data. The only guidance that I think the hourly

output could help with is rip currents and ocean currents. Overall, the hourly output is more than sufficient.

3. (For 10 unstructured domains only.) Has the increased coastal resolution in the model (albeit interpolated onto existing AWIPS gnds) improved the quality of nearshore wave fields?

Yes, the nearshore data looks improved. I can see that it brings higher energy waves to certain land points, which means that the higher resolution near the coast is accurately simulating refraction in shallow waters.

4. (For 10 unstructured domains only.) Are the extent and resolution of rip current output points sufficient? Does this rip current output have the potential to be a useful coastal hazard guidance, following sufficient validation?

Yes, the extent and resolution of rip current output points is sufficient. It has the "potential" to be useful guidance but as mentioned before, it appears to have a very high bias for rip risk. Maybe it is a problem with the constant 2-4 foot surf that occurs often at our beaches? It is true that every day at Southern California beaches there are hazardous rip currents, but the output provides no variability making it hard to apply in an operational forecast. We need to be able to forecast when the rip current risk is higher than normal and the output as it is now does not help with making that forecast.

5. (For 10 unstructured domains only.) Are the extent and resolution of runup (erosion/overwash) output points sufficient? Do you consider this erosion/overwash output to be a useful future guidance source, following sufficient validation?

N/A

Recommendation:

Implement as proposed X Reevaluate after changes _____
Do not implement _____

* The changes to the wave data look good, but would really like to see the rip current risk high bias fixed. Still, I think the new NWPS should be implemented.

Model Implementation Subjective Evaluation Report

Scientific Review Team Member: Paul R. Stanko _____

Region/Service Center/Company Representing: NWS Pacific Region _____

Proposed Change: NWPS v1.2

Project Manager: Andre van der Westhuisen (NCEP/EMC) / Dennis Atkinson (OSTI)

Real-Time Parallel Runs:

General comments: The month of May was characterized by trade wind swell from a mean direction of 100 degrees. This led to a long lived swell blocking event at the Tanapag buoy near Saipan, with the effect that GlobalWave and NWPSCG1 chronically overforecast the buoy readings. However, CG2 did significantly better, underscoring that sometimes resolution really is important. Here are some comments from other WFO Guam staff members:

Mike Ziobro: "I had often wondered how observers were calling in a north swell when we only had an east swell reported elsewhere. On Nearshore Wave Prediction System, I then saw the swell wrapping around the island, and near that area it was coming from the north, as the observer stated."

Ken Kleeschulte: "In previous days, I had seen zero waveheight values in the lee of the islands. This bothered me, however, I have not seen this behavior recently, so one of the upgrades may have resolved this."

Mike Middlebrooke: "There is no credible high resolution wave data out here. I hereby excuse myself from taking this high resolution wave model seriously." (My addendum: The purpose of the high resolution is only to do a better job of refraction, wraparound, and shallow water physics; and THIS we DO have the data for. Largely the swell info is merely inherited from GlobalWave).

Evaluation of expected benefits:

Please respond to the following questions and note if they are beneficial to you

1. Is the extension of the forecast guidance out to 144h useful to your organization? Does it show skill?

Without a doubt it is useful. When we used NWPS in the grids, we ended up with a discontinuity at day 4 when we switched from NWPS to GlobalWave. Usually this was small, at times it was noticeable though. This discontinuity will now be at Day 6, beyond the range of the coastal forecast, and at times perhaps even beyond the range of NDFD, which then makes it a mere curiosity within the office.

Regarding skill, the GlobalWave already has fair skill, the single biggest limitation probably being accuracy of GFS winds and resolution of land masses known to the model. NWPS inherits the swell and therefore starts out immediately with at least fair skill. As the attached graphs show, the improved modelling of the coasts does, in my opinion, raise the skill level to GOOD.

2. Does the hourly output interval of the guidance provide sufficient temporal resolution with which to compile marine forecasts?

Honestly, during the evaluation period, we were only seeing fluctuations between 3, 4 or 5 foot east swells. In this situation, 1 hour resolution is not only sufficient, it is overkill. However, in the event of a sudden, sharp swell arriving, then yes, the 1 hourly resolution could be quite helpful. If we had some sort of corroborating data showing the model had initialized well, the marine zones would probably stay at 3 hourly resolution since they represent an area, but in a high surf advisory, we could perhaps mention specific points and give an expected time of arrival.

3. (For 10 unstructured domains only) Has the increased coastal resolution in the model (albeit interpolated onto existing AWIPS grids) improved the quality of nearshore wave fields?

I have no basis to judge, since HFO was the unstructured office in Pacific region, not GUM.

4. (For 10 unstructured domains only) Are the extent and resolution of rip current output points sufficient? Does this rip current output have the potential to be a useful coastal hazard guidance, following sufficient validation?

I looked at Honolulu's rip current points, it sure looks good to me. I've asked to be included in the next round, so have a number of other folks most likely. I'm looking forward to Guam being included, right now, we just use a smart tool to convert surf height into rip risk, this seems more scientific. However, this opinion is limited due to my survey being in an unfamiliar area.

5. (For 10 unstructured domains only.) Are the extent and resolution of runoff (erosion/overwash) output points sufficient? Do you consider this erosion/overwash output to be a useful future guidance source, following sufficient validation?

We know that surf of 13 feet or more, caused by swells of 10 feet or more, can cause inundation in low lying areas. We look forward to being able to take a look at this, but currently have no basis to judge.

Recommendation:

Implement as proposed **Reevaluate after changes**

Do not implement

There is still some work to do, it should be noted though that this is a significant step forward.

Alaska faces many unique challenges for wave forecasting due to steep bathymetry, some of the greatest tidal fluctuations in the nation, and most intense weather systems in the country, with some low pressure systems reaching 940mb and accompanied by 100 mph wind gusts. As this study occurred during a summer month, it does not reflect the most extreme wave and weather conditions experienced by mariners in Alaska. However, this study does occur during the active tourism season during which a forecast difference of 1 or 2 ft can determine whether or not a boat is able to complete a fishing tour. As a result, the wave height forecast has direct implications for local tourist business owners and many small communities in Alaska where fishing or tourism are the main sources of income.

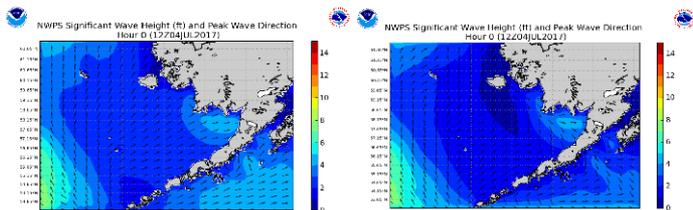
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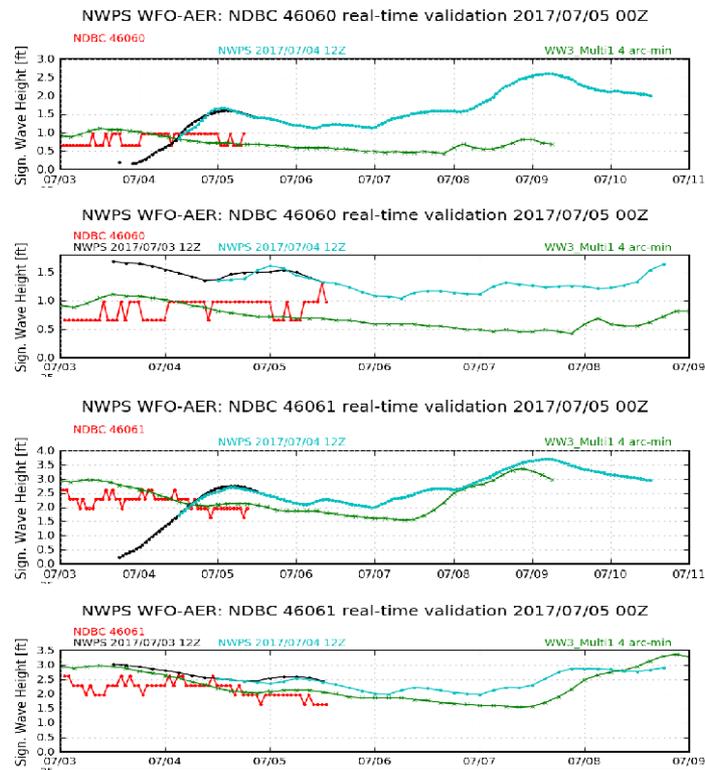
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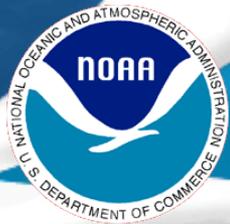
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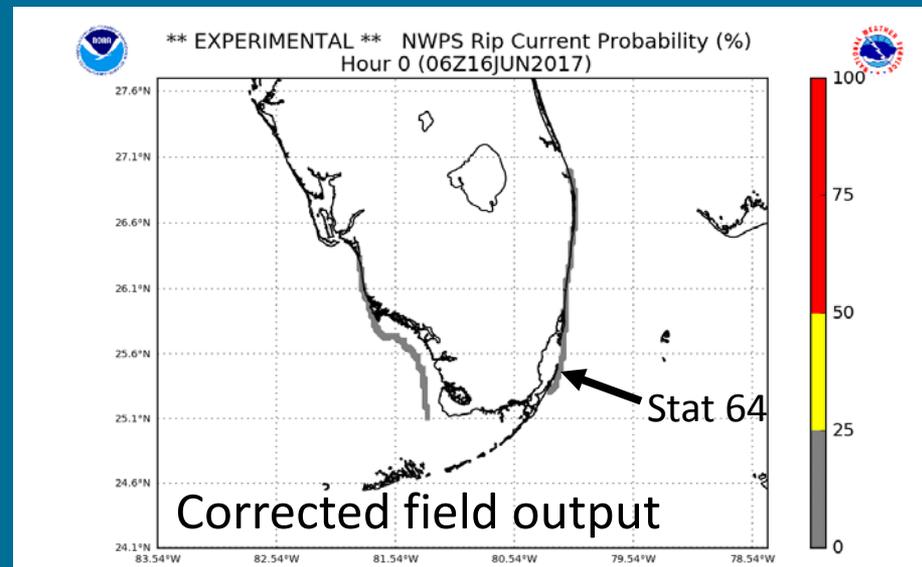
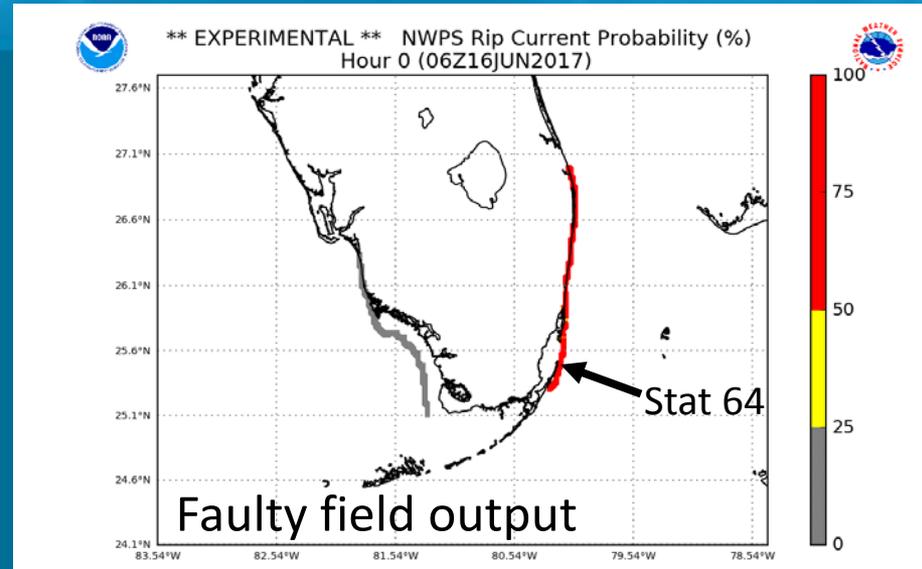
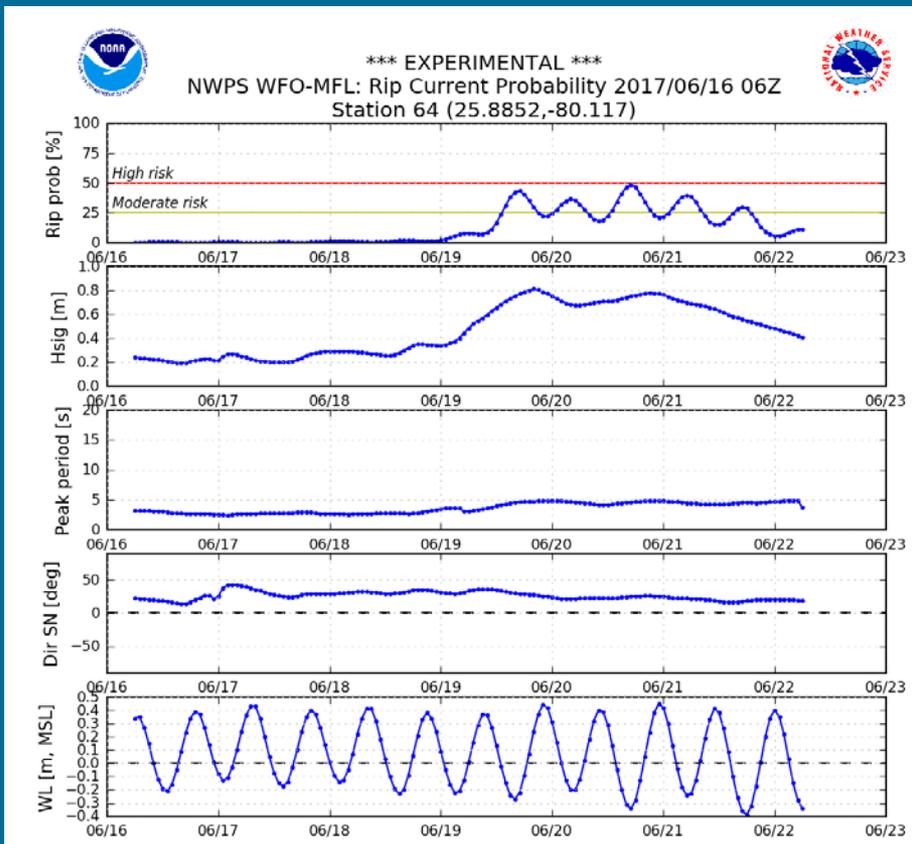
BACKUP SLIDES

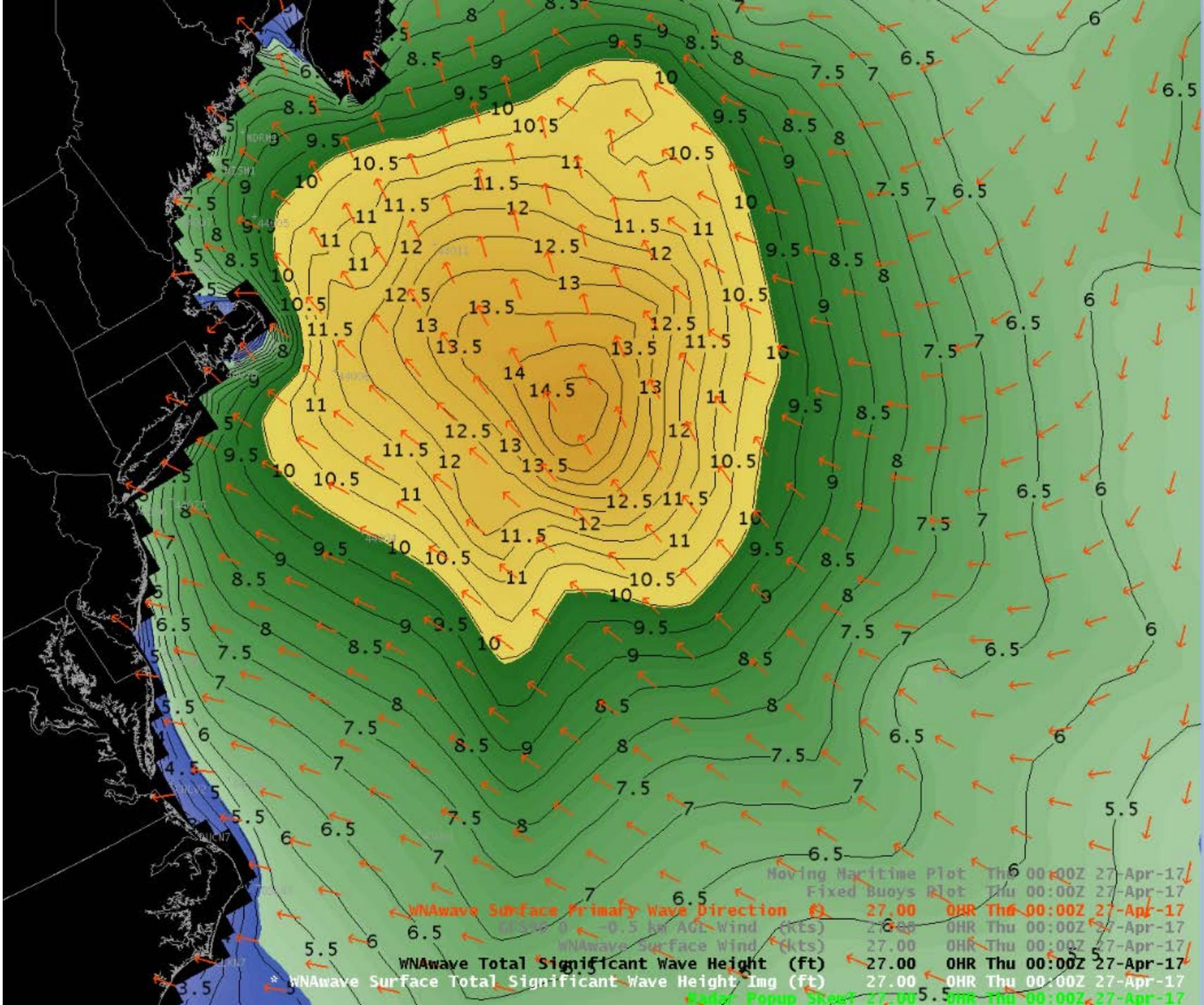




Corrected rip current field plot

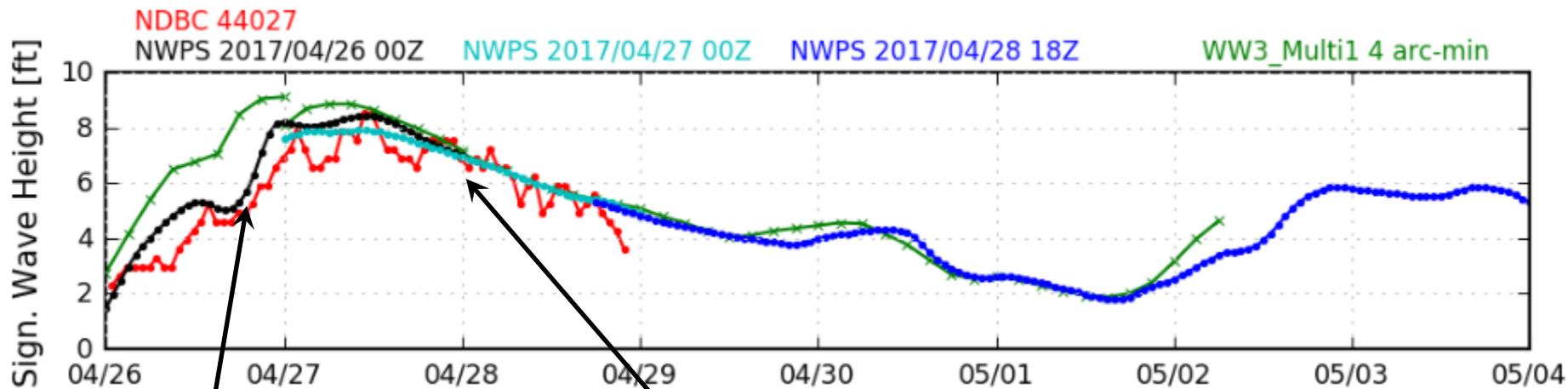
Field plot of rip current probabilities incorrectly included an additional factor 100 (top) which has now been corrected (bottom).





Moving Maritime Plot Thu 00:00Z 27-Apr-17
 Fixed Buoys Plot Thu 00:00Z 27-Apr-17
 WNAwave Surface Primary Wave Direction (°) 27.00 OHR Thu 00:00Z 27-Apr-17
 WNAwave Surface Wind (kts) 27.00 OHR Thu 00:00Z 27-Apr-17
 WNAwave Surface Wind (kts) 27.00 OHR Thu 00:00Z 27-Apr-17
 WNAwave Total Significant Wave Height (ft) 27.00 OHR Thu 00:00Z 27-Apr-17
 WNAwave Surface Total Significant Wave Height (ft) 27.00 OHR Thu 00:00Z 27-Apr-17
 Radar Popup Skew 27.00 OHR Thu 00:00Z 27-Apr-17

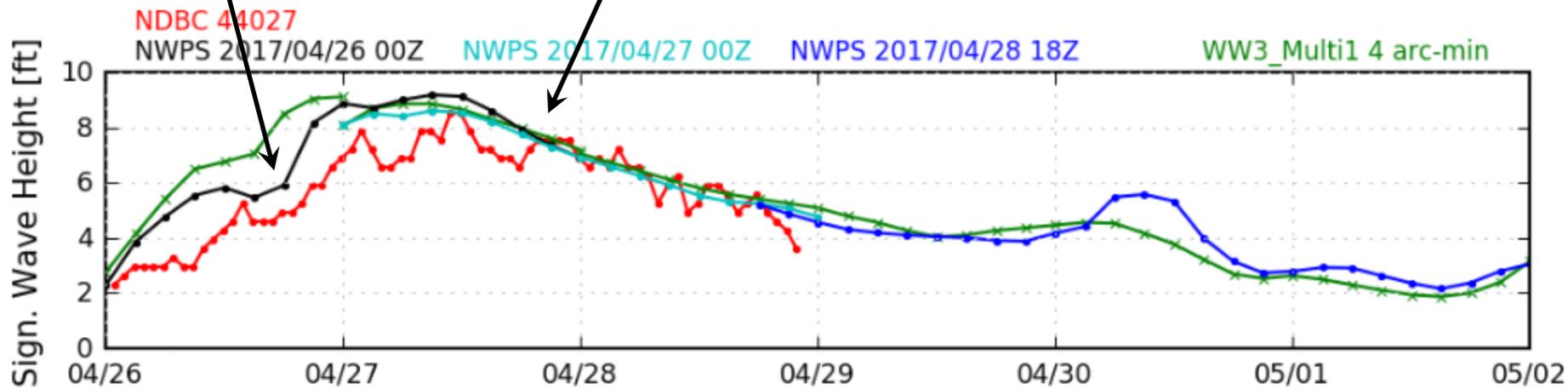
NWPS WFO-CAR: NDBC 44027 real-time validation 2017/04/28 18Z



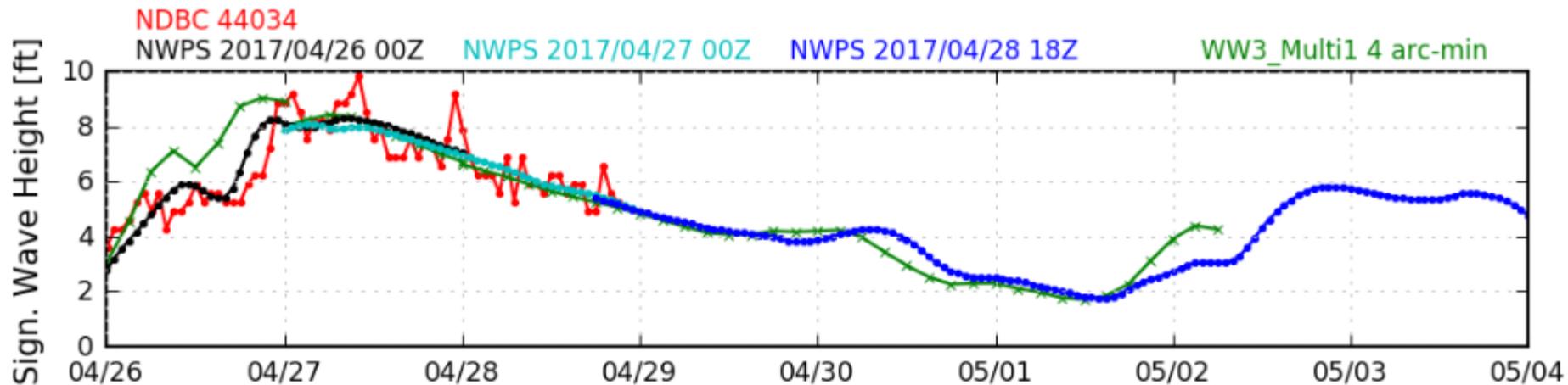
Stable boundary conditions (cold SST) suppress winds at beginning of fetch. Forecaster winds work better with WW3 winds too high.

Waves arrive from portion of fetch over warmer SST

NWPS WFO-CAR: NDBC 44027 real-time validation 2017/04/28 18Z



NWPS WFO-CAR: NDBC 44034 real-time validation 2017/04/28 18Z



NWPS WFO-CAR: NDBC 44034 real-time validation 2017/04/28 18Z

