



Kick Off Meeting

Great Lakes Wave (GLW) System Q1FY15 Upgrades

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Presentation Outline



- **Overview**
 - System overview
 - Scope of changes
 - Motivation
 - Science testing
 - Parallel evaluation



System Overview

- **System description**

- One system, two configs
 - GLW/NAM (“early”) + GLWN/NDFD (“late”)
 - 4 + 4 Cycles/day (early, glw; late; glwn)
- Grid (lon x lat): 0.05 x 0.035 (~ 4km), 327 x 235
 - Single domain covering all major lakes (Superior, Michigan, Huron, Erie, St. Clair)
- Upstream dependency: NAM and NDFD model surface winds, air-sea temperatures and ice.
- Primary customer base: Great Lakes WFOs, Buffalo, NY
Cleveland, OH Chicago, IL Detroit, MI Duluth, MN
Gaylord, MI Green Bay, WI Grand Rapids, MI Marquette,
MI Milwaukee, WI Northern Indiana.



Overview of Previous Changes

- **Previous changes in Q1FY14**
 - A new physics package for wave growth under wind seas
 - A new physics package for wave dissipation due to wave breaking.
- **New physics significantly improved model skill for wave height, especially in regions of strong storm wind forcing.**
- **Outcomes**
 - Correction boosted usage of the system by Great Lakes WFOs, some of which are now using solely WW3 (no longer GLERL model) in their wave guidance.



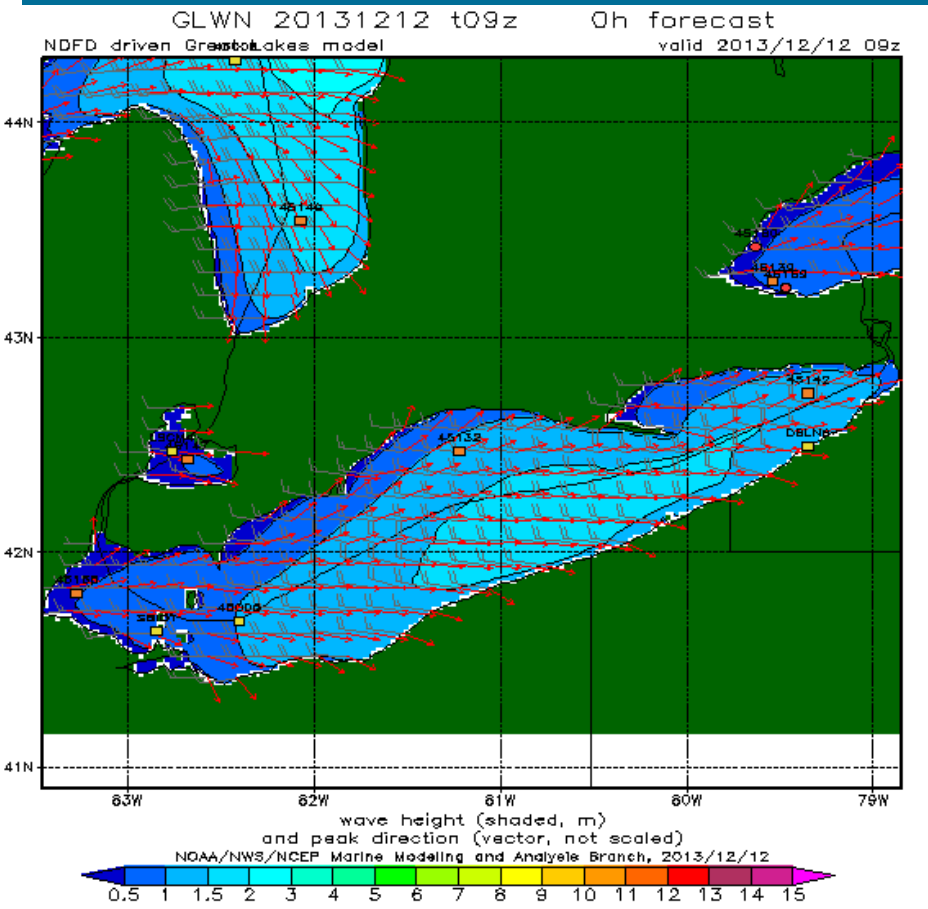
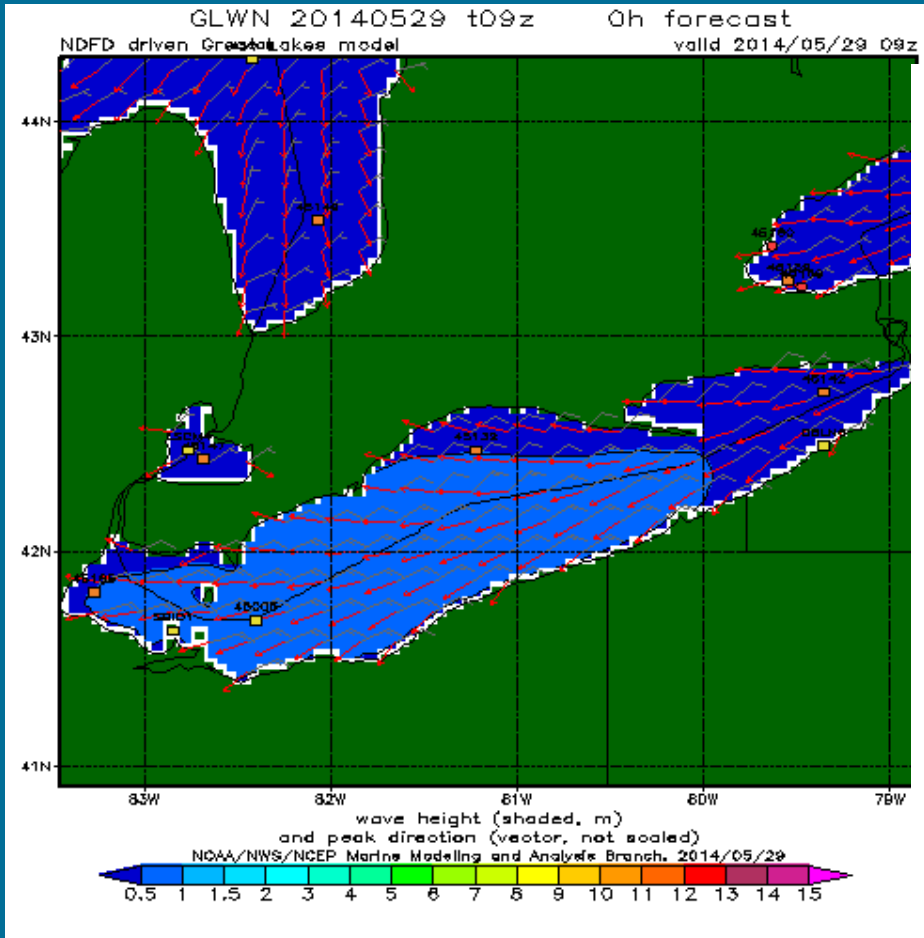
GLW Upgrades for Q1FY15



- **Spatial resolution increase from ~4km to ~2km**
 - Old Grid (lon x lat): 0.05 x 0.035 (~ 4km), 327 x 235
 - New Grid Grid (lon x lat): 0.025 x 0.0175 (~ 2km), 688 x 468
 - Still single domain covering all major lakes
 - Motivation:
 - Match higher res winds available from NDFD and NAM (2.5km).
 - Requirement from WFOs: higher resolution near coastal regions
- **Intake of new wind data from NAM**
 - Currently GLW uses 12km NAM data up to 84h
 - Change to a combination of NAM smartinit at 2.5km, NAM 5km and NAM 12km, matching NDFD 144h forecast range (or up to 192h...)
- **Intake of new ice concentrations**
 - Currently uses NAM ice mask (no actual concentrations)
 - Change to a either NIC ice concentrations (depends on NCO making available this year) or Bob Grumbine's climatology

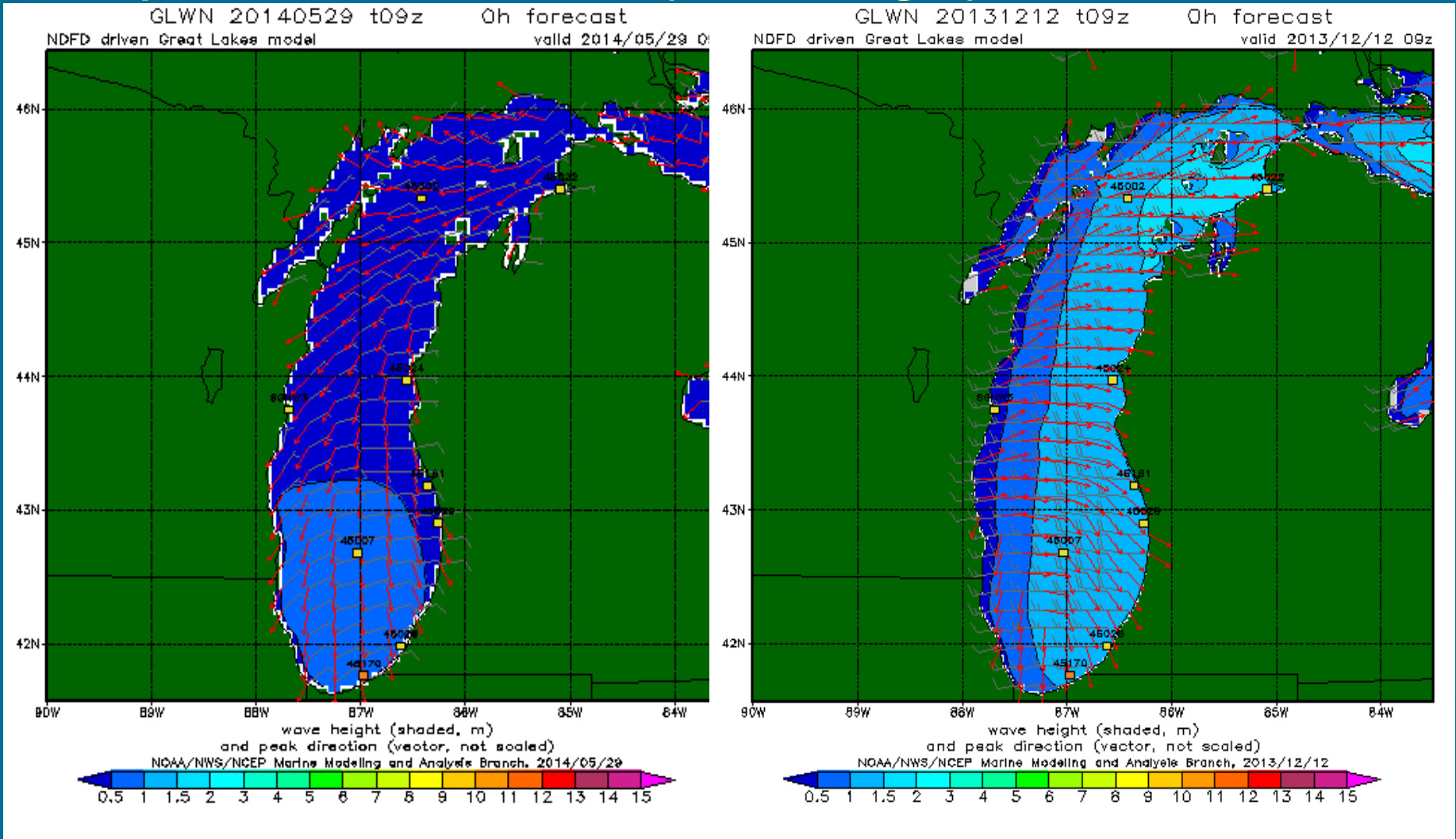
GLW Upgrades for Q1FY15

- Spatial resolution increase (Lake Erie)



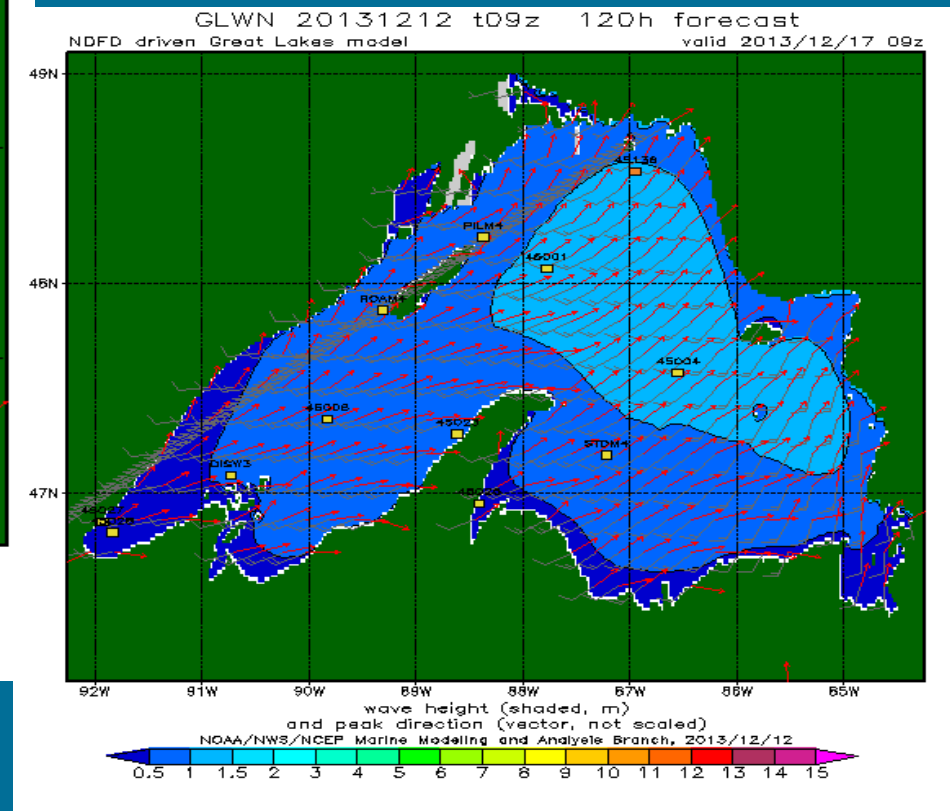
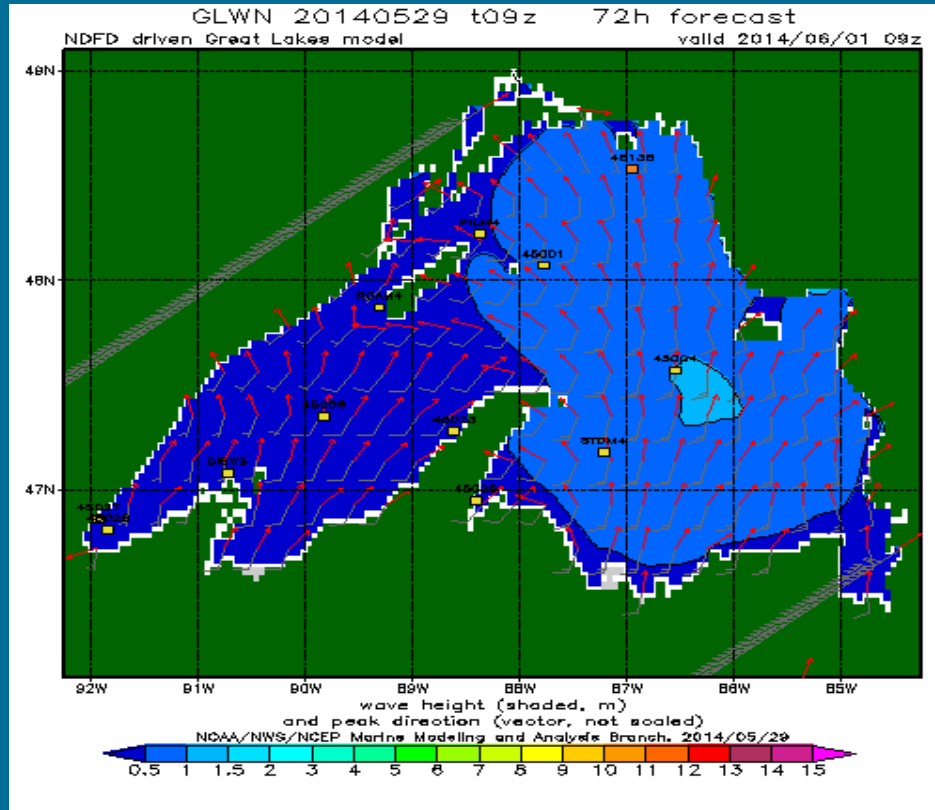
GLW Upgrades for Q1FY15

- Spatial resolution increase (Lake Michigan)



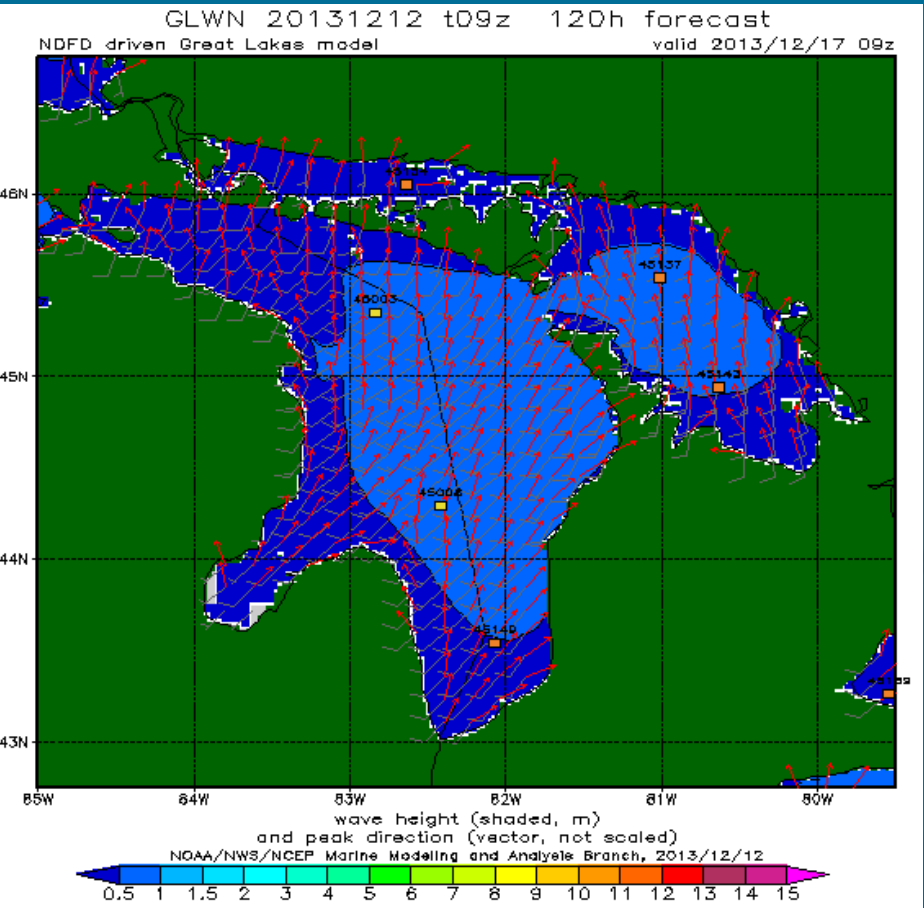
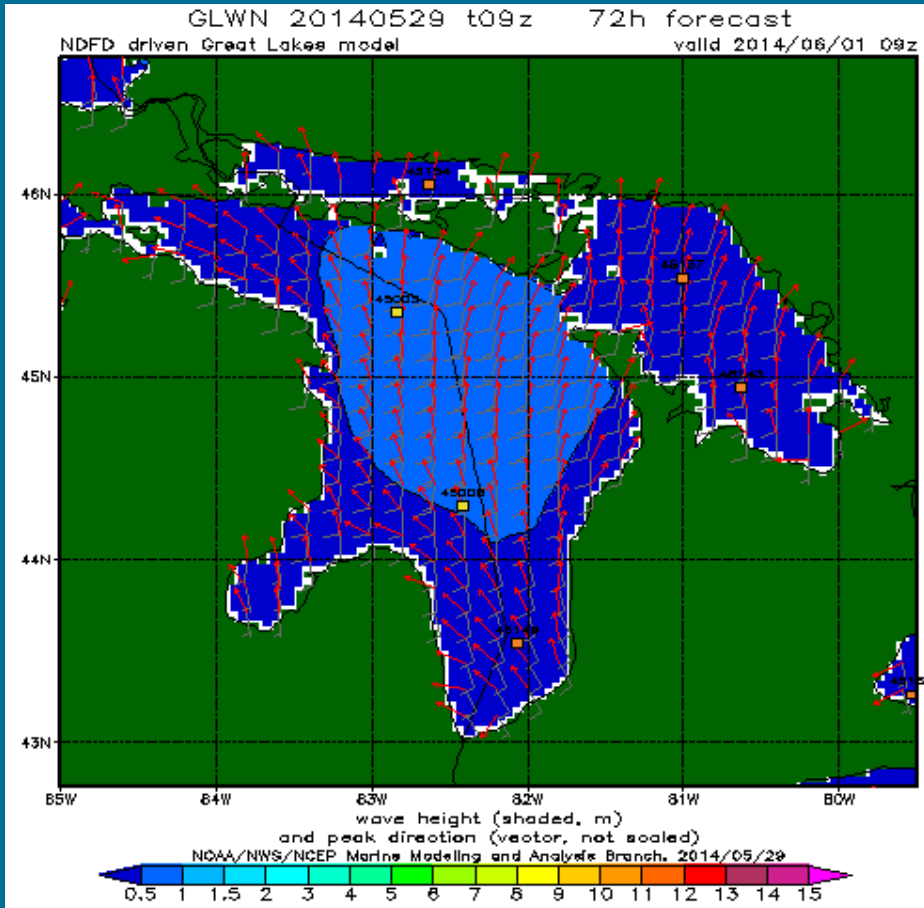
GLW Upgrades for Q1FY15

- Spatial resolution increase (Lake Superior)



GLW Upgrades for Q1FY15

- Spatial resolution increase (Lake Huron)

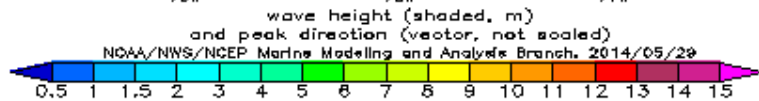
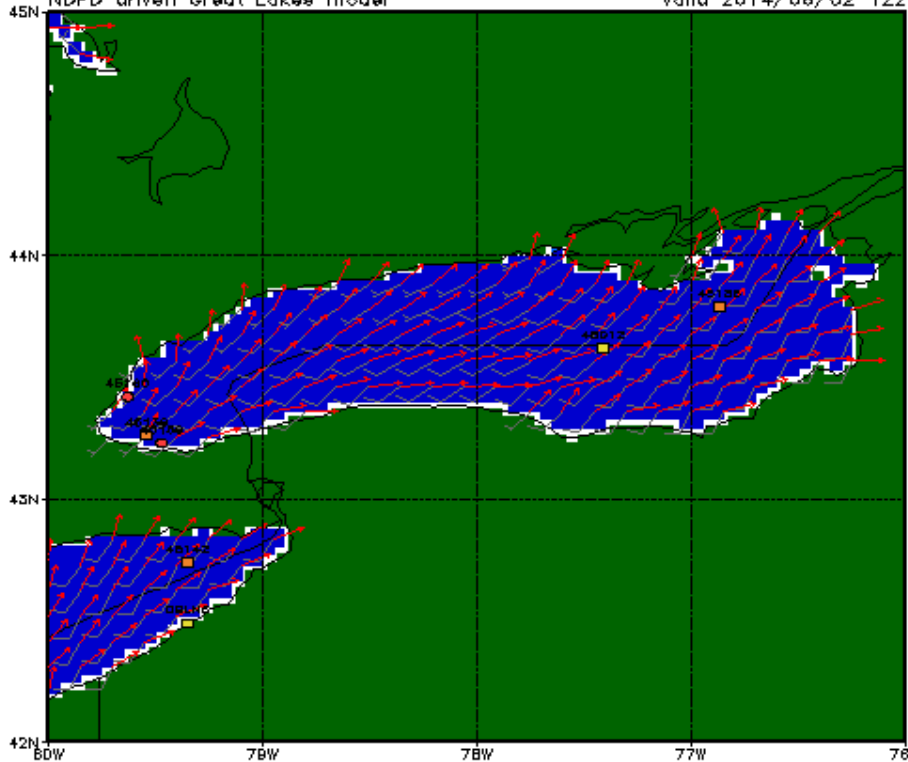




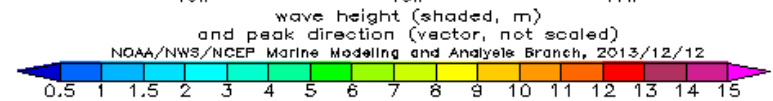
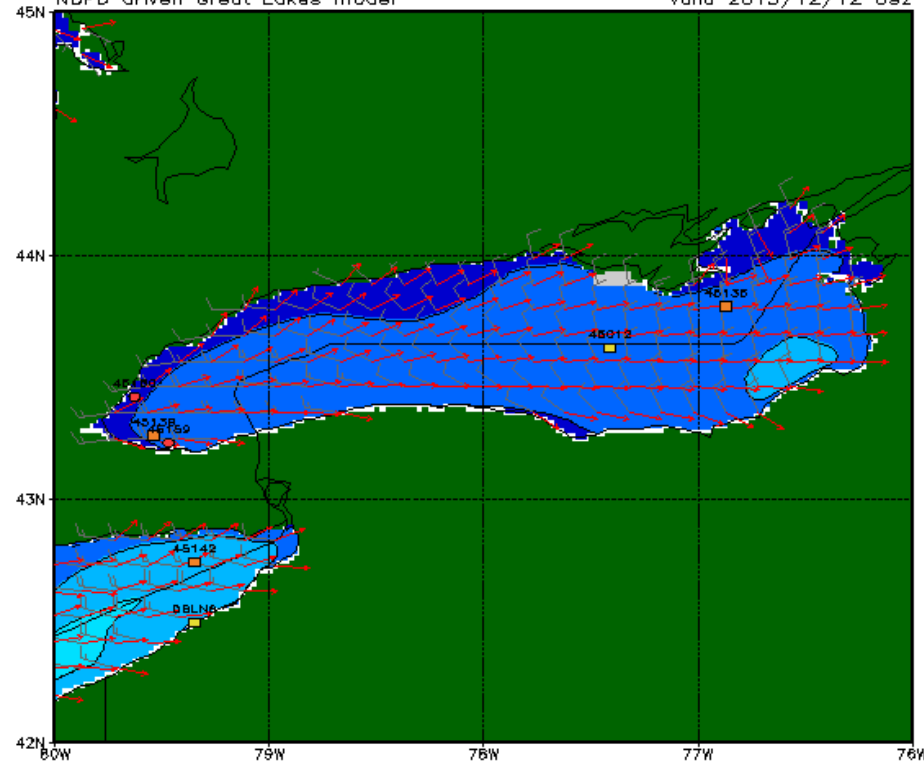
GLW Upgrades for Q1FY15

- Spatial resolution increase (Lake Ontario)

GLWN 20140529 t09z 99h forecast
NDFD driven Great Lakes model valid 2014/06/02 12z



GLWN 20131212 t09z 0h forecast
NDFD driven Great Lakes model valid 2013/12/12 09z

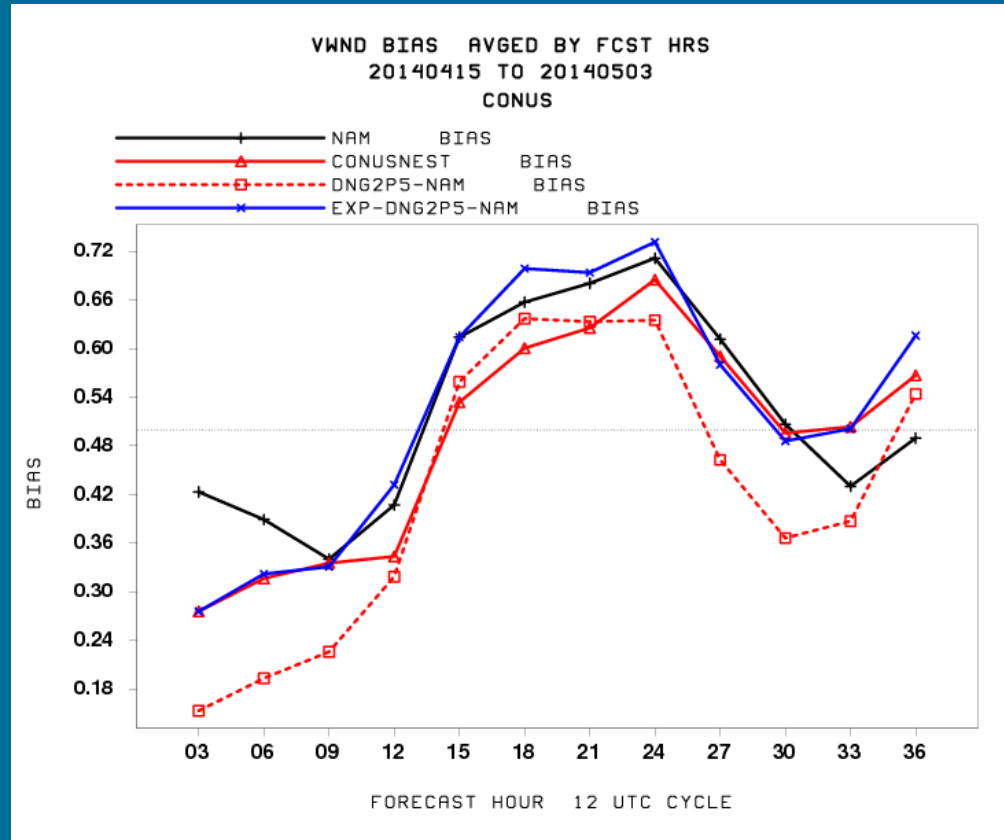




GLW Upgrades for Q1FY15



- Intake of new wind data from NAM
 - CONUS nest (5km) lower bias relative to 12km NAM
 - SMARTINIT downscaling lower biases relative to 5km NAM
 - Future SMARTINIT would include 1km terrain adjustment (land-lake transition better represented?)
 - Expand NAM input from 84h forecast range to match NDFD's 144h or even 180h (SMARTINIT 5km from NAM DGEX goes out to 192h)

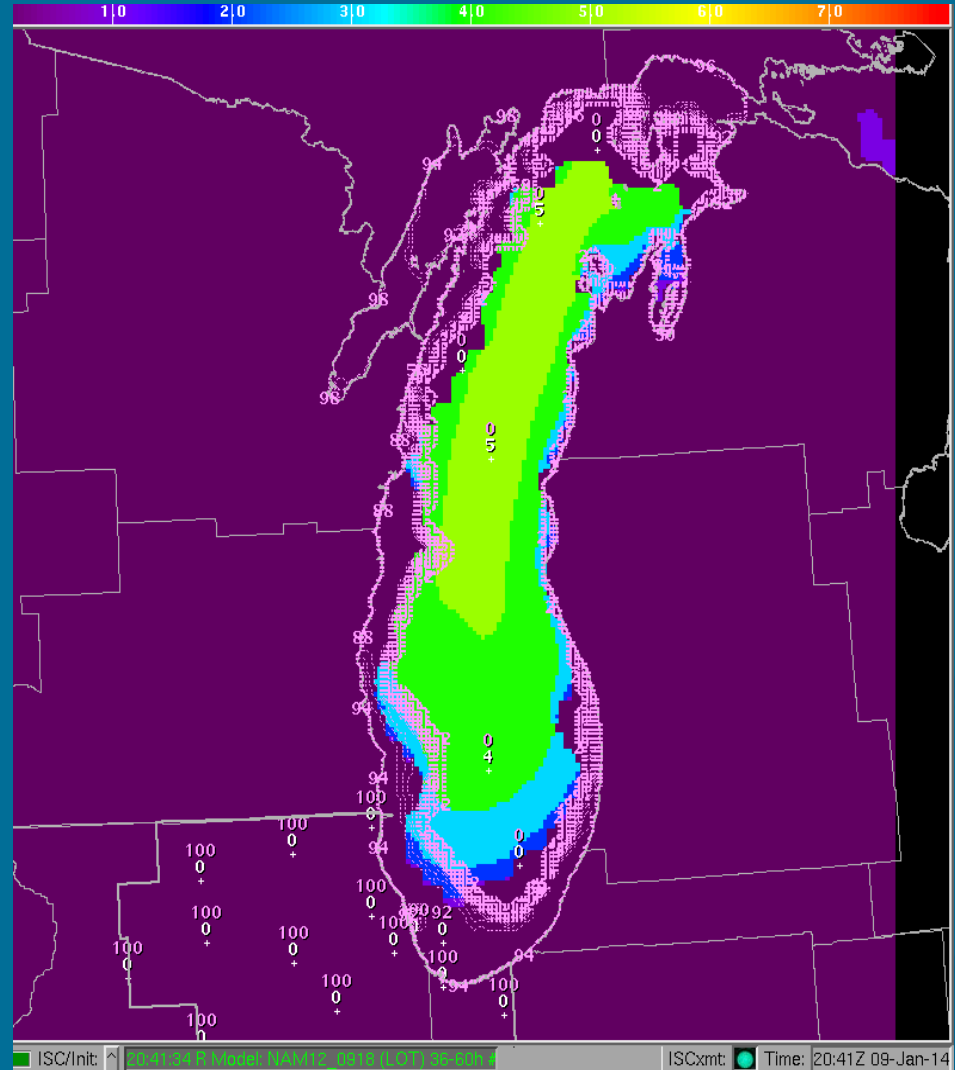


Slide borrowed from Jeff McQueen SMARTINIT update talk on May 08, 2014



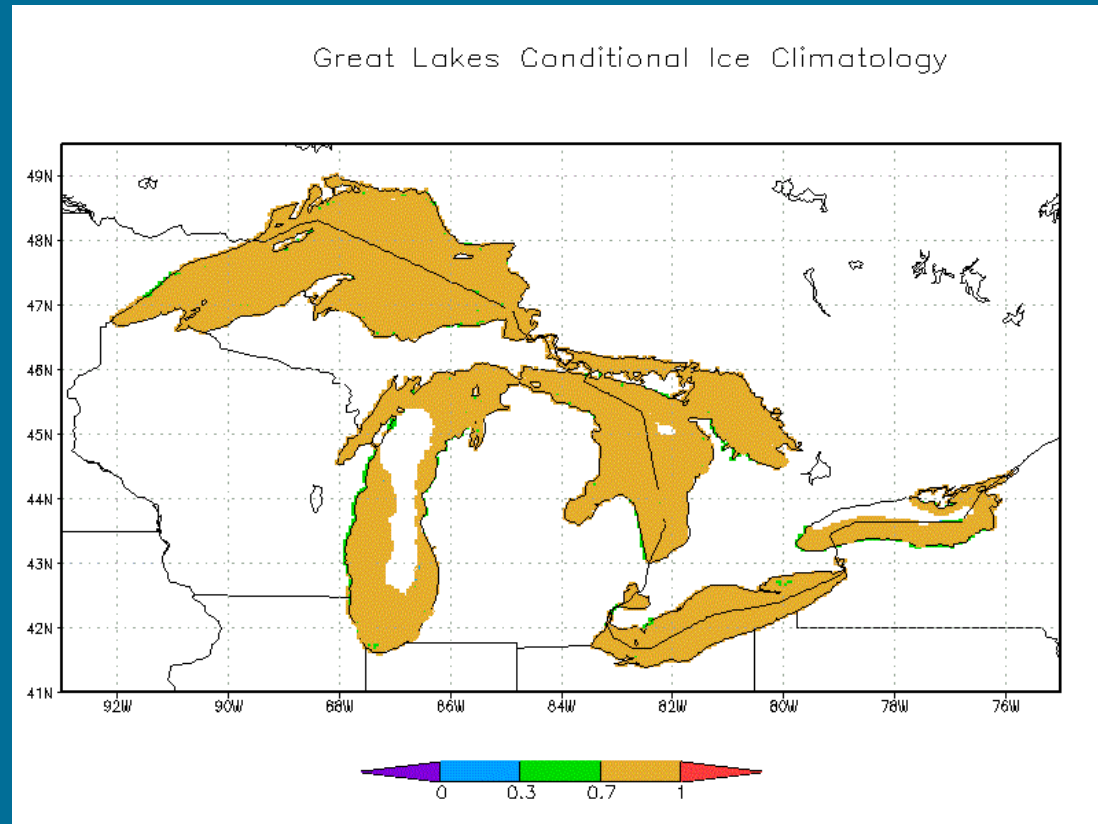
GLW Upgrades for Q1FY15

- **Intake of new ice concentrations**
 - NAM ice mask (from NIC) is extremely conservative
 - Large areas where there should be waves are masked out



GLW Upgrades for Q1FY15

- **Intake of new ice concentrations**
 - NAM ice mask (from NIC) is extremely conservative
 - Large areas where there should be waves are masked out
 - Solution:
 - NIC ice concentrations (NCO in the pipeline)
 - Bob Grumbine's conditional climatology (alternative if NCO cannot implement on time for upgrade)





GLW Upgrades for Q1FY15

- **Summary of scope**
- **Spatial resolution increase from ~4km to ~2km**
- Grid (lon x lat): 0.025 x 0.0175 (~ 2km), 688 x 468
- Single domain covering all major lakes

- **Intake of new wind data from NAM**
- Use a combination of NAM SMARTINIT
 - 0-36h 1hrly 2.5km (from 4km NAM)
 - 39-60h 3hrly 2.5km (from 4km NAM)
 - 63-84h 3hrly 5km (from 12km NAM)
 - 87-144(192)h 3hrly 5km (from 12km DGEX)

- **Intake of new ice concentrations**
- Use either NIC ice concentrations (depends on NCO making available this year) or Bob Grumbine's climatology



GLW Upgrades for Q1FY15

CPU requirements

- **PREP**
 - Now: 1 node, 1 min
 - Then: 1 node, 2 min
- **FORECAST**
 - Now: 14 nodes, 3-5 min
 - Then: 16 nodes, 7 min (GLW matching 144h GLWN range)
- **POST**
 - Now: 2 nodes, 1 min
 - Then: 4 nodes, 1 min
- **PGEN (GLWN only)**
 - Now: 1 node, 1 min
 - Then: 1 node, 1 min



GLW Upgrades for Q1FY15



Local disk requirements (multiply by 8 daily cycles)

- **PREP (65Mb -> 330Mb)**
 - Now: wind (50Mb), ice (15Mb)
 - Then: wind (300Mb), ice (30Mb)
- **FORECAST (400Mb -> 1.1Gb)**
 - Now: outgrd (120-180Mb), outpnt (22-32Mb), restart (90Mb)
 - Then: outgrd (700Mb), outpnt (32Mb), restart (350Mb)
- **POST (55Mb -> 175Mb)**
 - Now: grib2 (22-42Mb), bull (.5-.8Mb), cbull (.3-.5Mb), csbull (2.5-3.8Mb), spec (3.5-6Mb), wstp (.5-.8Mb)
 - Then: grib2 (160Mb), bull (1Mb), cbull (.5Mb), csbull (4Mb), spec (6Mb), wstp (1Mb)
- **PGEN (GLWN only, 4 cycles: 40Mb -> 160Mb)**
 - Now: grib2 (40Mb), awipsbull (<1Mb)
 - Then: grib2 (160Mb), awipsbull (<1Mb)
- Total daily (8 cycles) size hike (estimated): 3.5Gb to 13.5Gb



GLW Upgrades for Q1FY15

Changes to Output Products/Dataflow

- Product generation requirements
 - Spatial resolution increase will impact gridded output
 - Longer GLW forecast range will impact gridded and point outputs
- Data flow
 - NDFD winds spatial and temporal resolution hike already implemented!
 - We need NIC ice concentrations file in dcom!
 - Increased grib2 AWIPS files (4x size)
- TIN will address
 - Changes to gridded output spatial resolution increase
 - Changes to early run forecast range (from 84h to 144h (or 180h to match other wave models), affecting both gridded and point outputs.
- No downstream dependencies



GLW Upgrades for Q1FY15



- Concluded schedule
 - Base code fully implemented at EMC
 - EMC parallel running with increased spatial resolution
- Remaining schedule
 - Implement NAM SMARTINIT data intake (coordinate with Meso group)
 - Implement ice concentrations (NCO dependent, immediate: Grumbine's)
 - Regression testing
 - Start R2O transition
 - All NCO steps towards implementation



GLW Upgrades for Q1FY15

- Organizational scope (NCEP)
 - NCO branches
 - EMC Marine Modeling & Analysis Branch
- EMC Developer
 - Henrique.Alves@noaa.gov
- EMC POC
 - Henrique.Alves@noaa.gov
 - Arun.Chawla@noaa.gov
- External collaborators
 - GLERL, Detroit WFO and MDL