



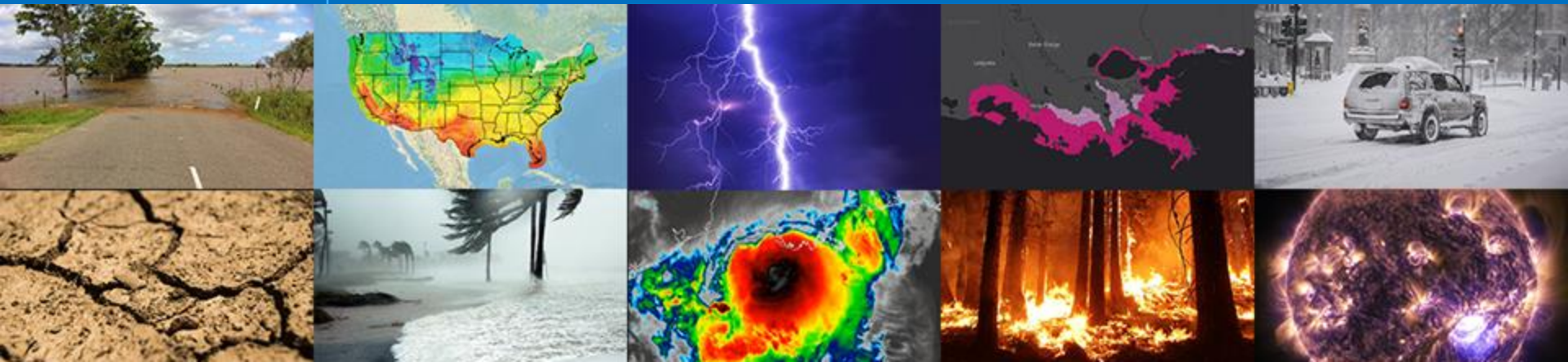
NATIONAL
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Updates on Wave Coupling for the Next Global Forecast System GFSv17

APRIL 10, 2024

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Acknowledgements to GFS & UFS Active Developers

<p>Atmospheric Physics</p> <p>NCEP/EMC: Jongil Han, Michael Barlage, Anning Cheng, Bing Fu, Hong Guan, Zhichang Guo, Sanath Kumar, Xu Li, Wei Li, Qingfu Liu, Eric Sinsky, Ruiyu Sun, Kevin Viner, Helin Wei, Bo Yang, Fanglin Yang, Rongqian Yang, Weizhong Zheng, Xiaojong Zhou</p> <p>ESRL/GSL: Ben Green, Joseph Olson, Tanya Smirnova, Shan Sun, Xia Sun, Michael Toy</p> <p>JCSDA/UCAR: Dom Heinzeller,</p> <p>ESRL/PSL: Lisa Bengtsson, Jian-Wen Bao, Clara Draper, Grant Firl, Songyou Hong, Phillip Pegion, Dustin Swales</p> <p>DTC: Ligia Bernardet, Weiw ei Li, Man Zhang</p>	<p>Data Assimilation</p> <p>NCEP/EMC: Catherine Thomas, Guillaume Vernieres, Daryl Kleist, Cory Martin, Andrew Collard, Jiarui Dong, Andy Eichmann, Travis Elless, Nick Esposito, Iliana Genkova, Azadeh Gholoubi, Tseganeh Gichamo, Brett Hoover, Xin Jin, Emily Liu, Haixia Liu, Hyun-Chul Lee, Xuanli Li, Ron McLaren, Dagmar Merkova, Sudhir Nadiga, Shastri Paturi, Ashley Stanfield, Steve Stegall, Andy Tangborn, Russ Treadon, Yaping Wang, Youlong Xia</p> <p>CIRES/GSL: Bo Huang, Mariusz Pagowski</p> <p>PSL: Clara Draper, Jeff Whitaker</p> <p>JCSDA/UCAR: Kriti Bhargava, Travis Sluka</p>	<p>Coupled Model Component Development</p> <p>NCEP/EMC: Jessica Meixner, Jiande Wang, Lydia Stefanova, Jun Wang, Yuejian Zhu, Neil Barton, Saeideh Banihashemi, Arun Chawla, Bing Fu, George Gayno, Robert Grumbine, Walter Kolczynski, Matthew Masarik, Avichal Mehra, Ali Salimi-Tarazouj, Denise Worthen</p> <p>ESRL/GSL: Ben Green, Shan Sun</p> <p>ESRL/PSL: Lisa Bengtsson, Phillip Pegion</p> <p>GFDL: Alistair Adcroft, Rusty Benson, Stephen Griffies, Robert Halberg, Matthew Harrison, Brandon Reichl, Marshall Ward</p> <p>NCAR: Alper Altuntas, Gokhan Danabasoglu, Keith Lindsay, Gustavo Marques</p> <p>NRL/ESMF: Gerhard Theurich</p> <p>GMU: Ben Cash, Jim Kinter, Lawrence Marx, Cristiana Stan</p> <p>FSU: Alexandra Bozec, Eric Chassignet, Alan Wallcraft</p> <p>NASA: Akella Santha</p> <p>Univ. Alaska: Katherine Hedstrom</p> <p>U. Mich.: Christiane Jablonowski</p> <p>Univ. Victoria: Andrew Shao</p>
<p>Field Evaluation</p> <p>NCEP/EMC: Alicia Bentley, Mallory Row, Shannon Shields</p> <p>NWS Regional SSDs</p> <p>NCEP Centers</p>	<p>Products</p> <p>NCEP/EMC: Hui-Ya Chuang, Wen Meng, Andrew Benjamin, L. Gwen Chen, Yali Mao, Bo Cui</p>	
<p>Atmospheric Composition</p> <p>NCEP/EMC: Partha Bhattacharjee, Jeff McQueen, Raffaele Montuoro, Li Pan, Ivanka Stajner</p> <p>ARL: Barry Baker, Patrick Campbell, Rick Saylor</p> <p>ESRL/GSL: Georg Grell, Shan Sun, Li (Kate) Zhang</p> <p>CSL: Gregory Frost, Jian He, Stuart McKeen, Siyuan Wang</p> <p>NESDIS/STAR: Ethan Hughes, Shobha Kondragunta, Xiaoyang Zhang</p>	<p>Infrastructure</p> <p>NCEP/EMC: Rahul Mahajan, Jun Wang, Kate Friedman, Lin Gan, George Gayno, Ed Hartnett, Dusan Jovic, Walter Kolczynski, Hang Lei, Terry McGuinness, Alex Reichert, Mallory Row, Edward Stafford, Henry, Winterbottom, Jack Wollen, Denise Worthen</p> <p>Redline Performance: David Huber</p>	<p>Coupled Model Evaluation</p> <p>NCEP/EMC: Lydia Stefanova, Jiande Wang, Michael Barlage, Neil Barton, Partha Bhattacharjee, Zhichang Guo, Robert Grumbine, Wei Li, Avichal Mehra, Ghazal Mohammadpour, Jiayi Peng, Sulagna Ray, Huug van den Dool, Helin Wei, Youlong Xia, Weizhong Zheng</p> <p>CPC: Laura Ciasto, Yanyun Liu, Wangju Wang, Jieshun Zhu</p> <p>ESRL/PSL: Chris Cox, Maria Gehne, Juliana Dias, Zachary Lawrence, Amy Solomon</p> <p>GMU: V. Krishnamurthy, Eunkyoo Seo, Cristiana Stan</p>



Agenda

- Overview of GFSv17
- Unstructured Grid
- Prototype Results
- Future Work



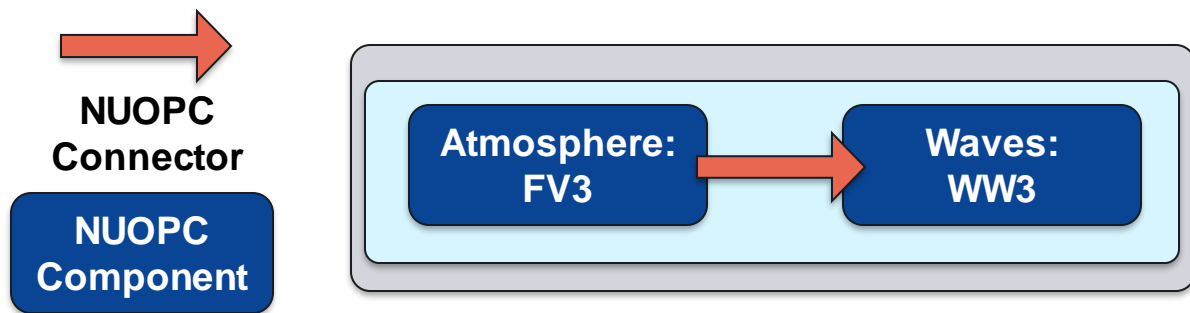
Overview of GFS



- Global deterministic model
- Run 4 times a day out to 16 days
 - Hourly output for first 120 hours
 - 3 hourly for days 6-16
- Global Data Assimilation System (GDAS)
- Provides initial and/or boundary conditions for multiple downstream forecast systems



GFSv16



- **Updates for Wave Model Component:**

- Increase resolution of wind forcing: 3 to 1 hour
- Added ocean surface current forcing from RTOFS
- Grid redesign
 - Simplified grid with increased base resolution
 - Removed 4 arcmin coastal grids
- Objective Physics/Source-term Optimization
- Extended forecast range: 180 to 384 hours

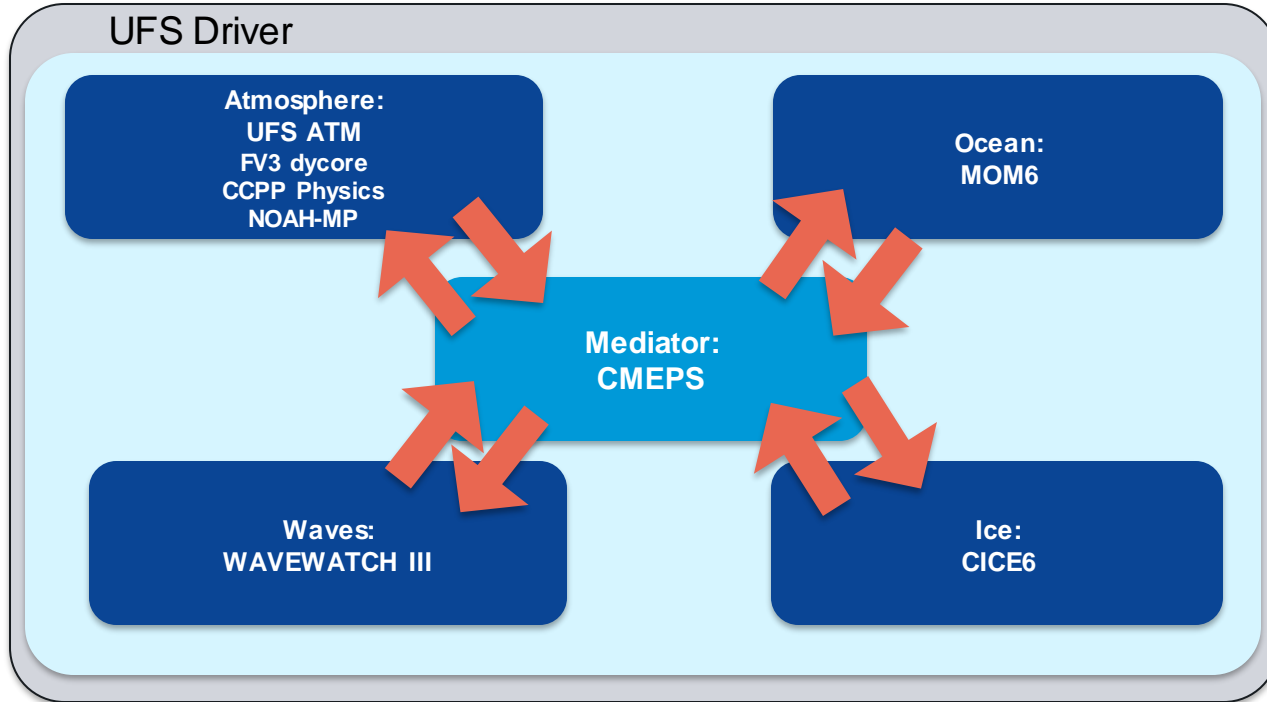


Goals/Scope of GFSv17

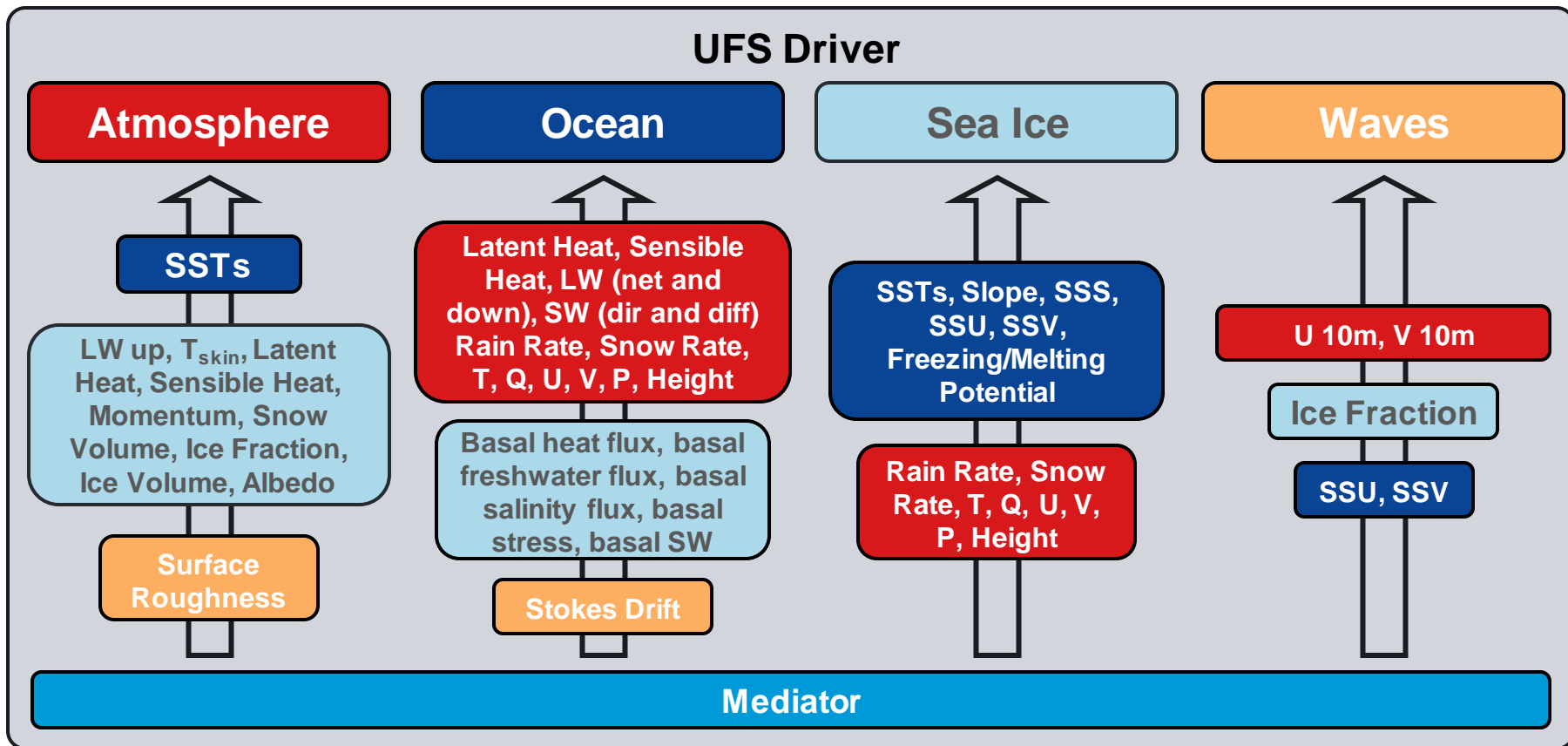
- Coupled forecast model (atm, land, ocn, ice, wav)
- Improved DA with JEDI for non-atm components
- Towards consolidation of NCEP production suite
- Improve on known issues in GFSv16



GFSv17



UFS Coupling Schematic



Expected Benefits of GFSv17

Wave:

- Address low bias in high amplitude wave events
- Improved swell forecasts in the Pacific
- Possibly increase the global resolution or add high resolution coastal nests (unstructured grids)

Coupling:

- New ocean and ice components, providing a consistent atmosphere-ocean-ice-wave deterministic forecast
- Based on ECMWF, UKMet and ECCO, possible impact of coupling:
 - Improve general skill in the middle and upper troposphere
 - Largest impacts to be in relation to tropical cyclones:
 - Track, central pressure, intensity, and false alarms
 - Note, there is no guarantee we will see this in GFSv17

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Mogensen, K., et al. "Effects of ocean coupling on weather forecasts." *ECMWF Newsletter* 156 (2018).

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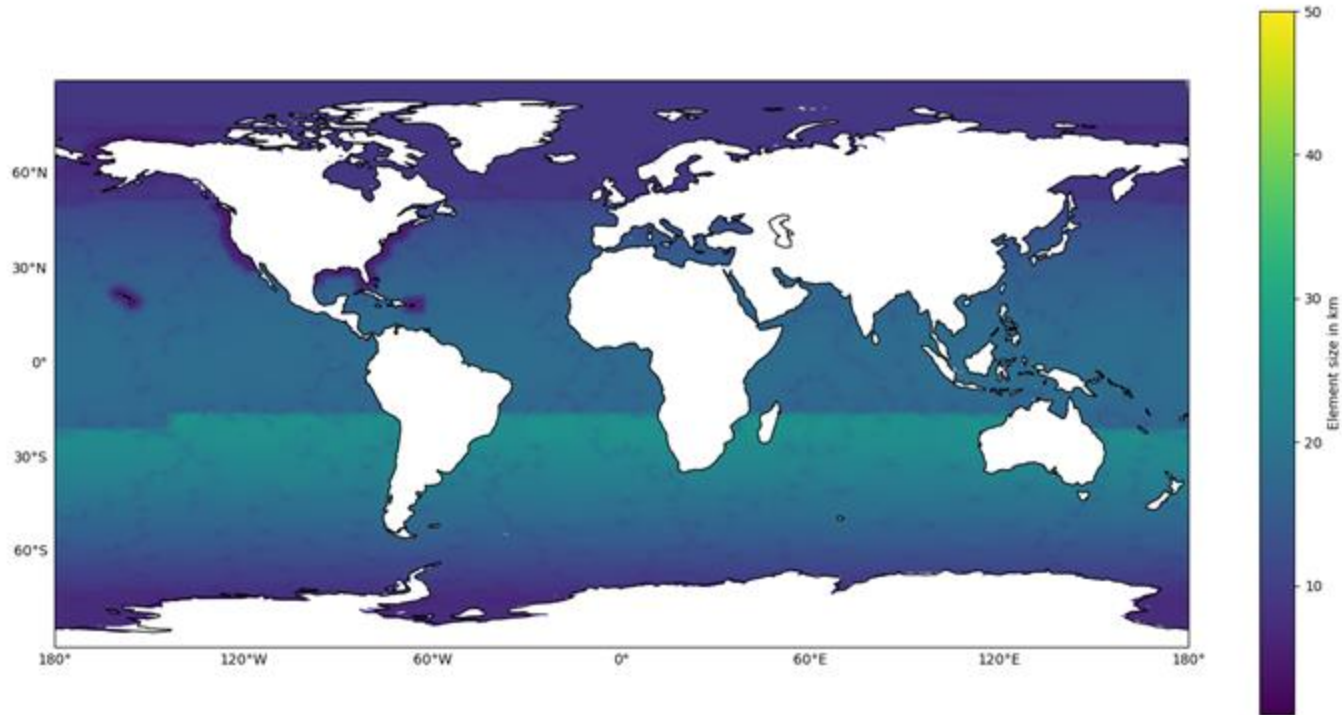


HR Prototypes

- **High resolution prototypes are being conducted in preparation for GFSv17**
 - Summer, Winter and Hurricane periods
- **HR3 is our current prototype which includes unstructured grids for the wave model.**
- **Today's presentation results:**
 - Focus on single IC date of 20200913 00z, comparing the following:
 - **multi-1:** Operational model at the time
 - **GFSv16:** Retrospective run
 - **HR1/HR2:** Previous prototypes
 - **HR3a & HR3b:** First to use unstructured grid (a. 13km b. 9km atm)



Unstructured Grid for HR3

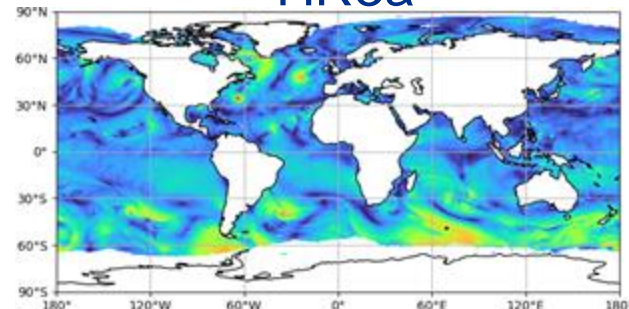
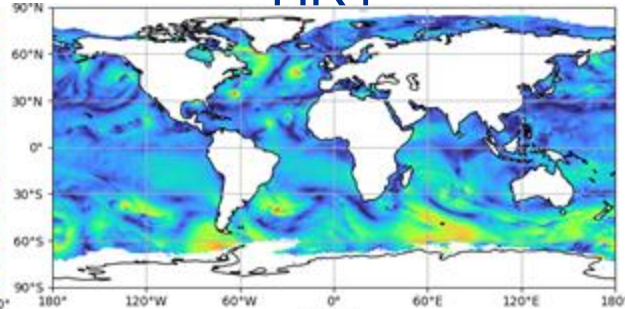
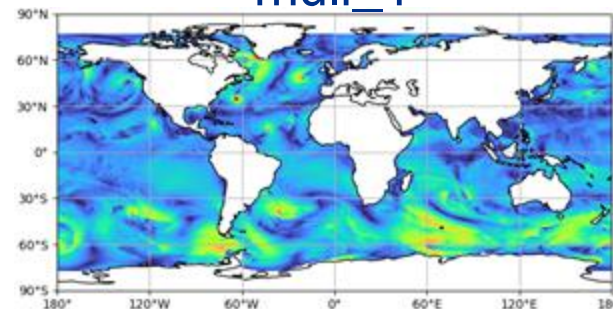


Wind Speed 20200913 00z FHR 048

muli_1

HR1

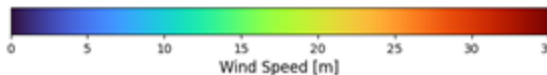
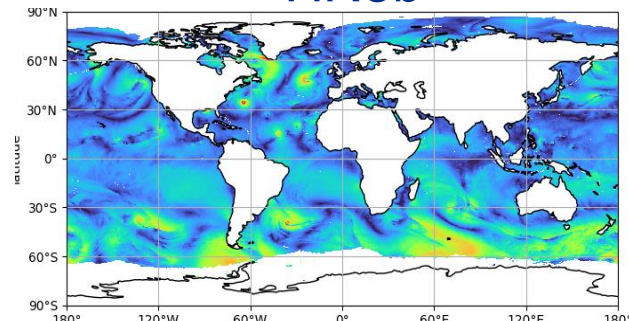
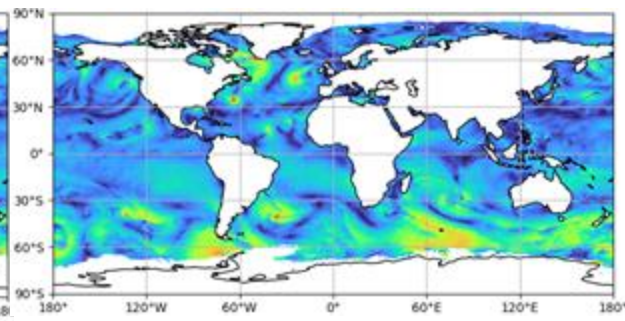
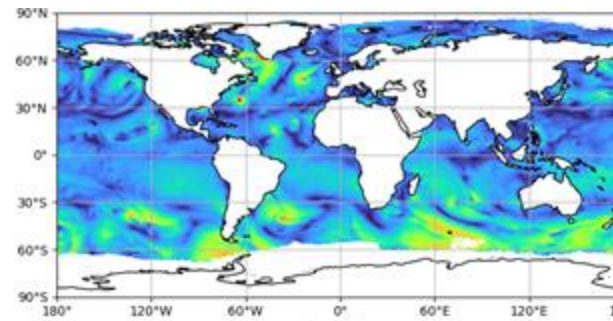
HR3a



GFSv16

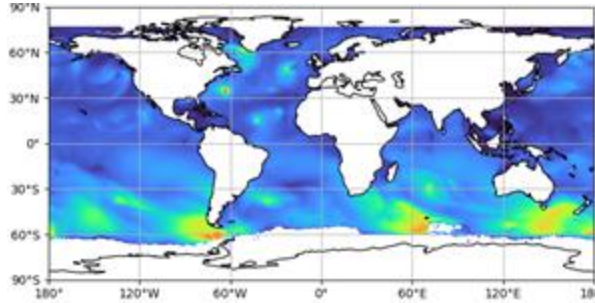
HR2

HR3b

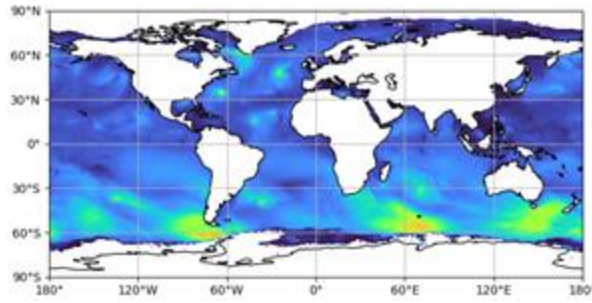


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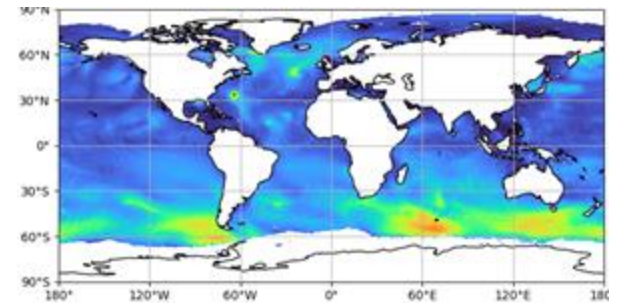
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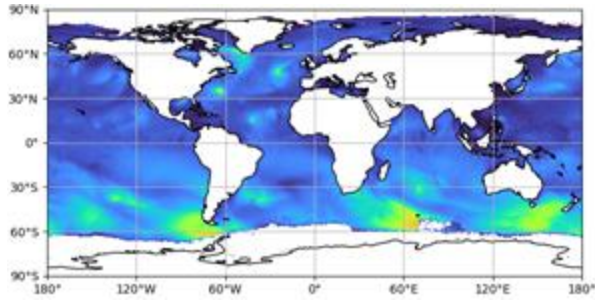
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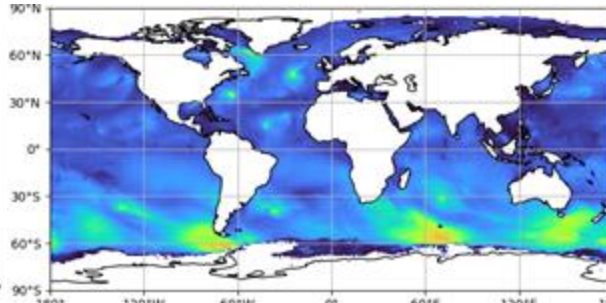
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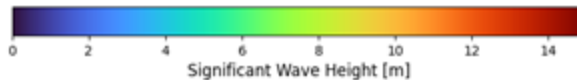
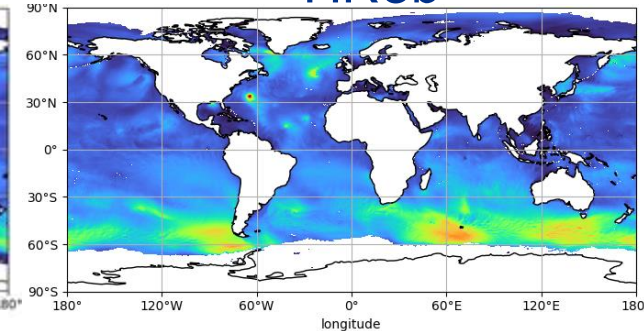
GFSv16



HR2

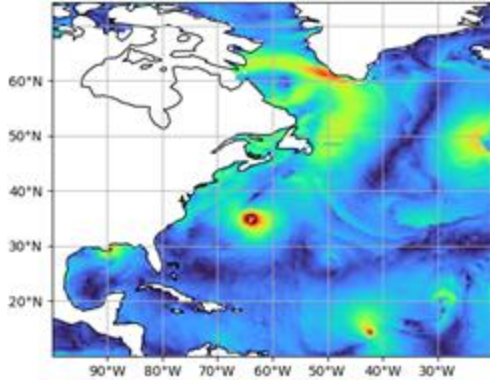


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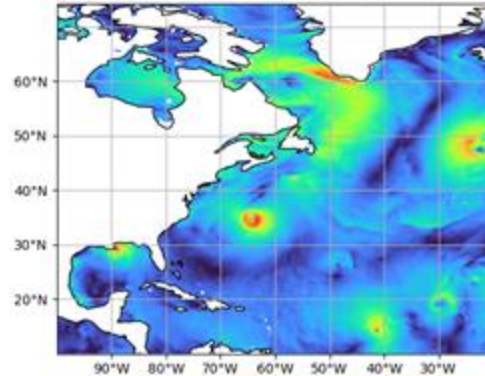


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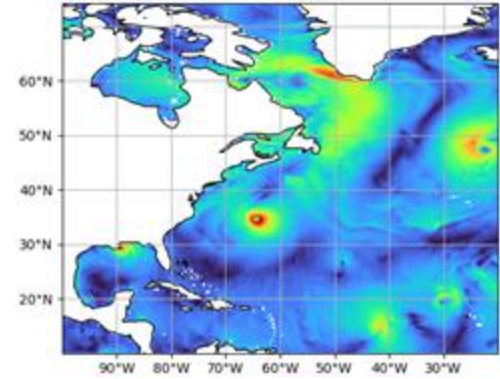
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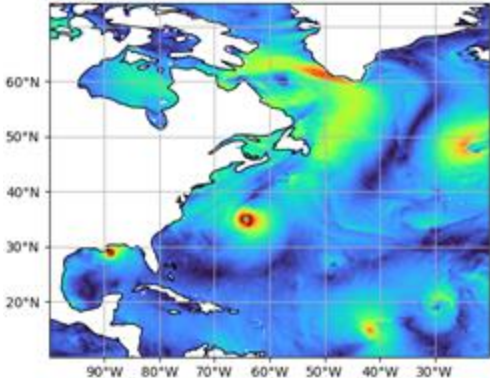
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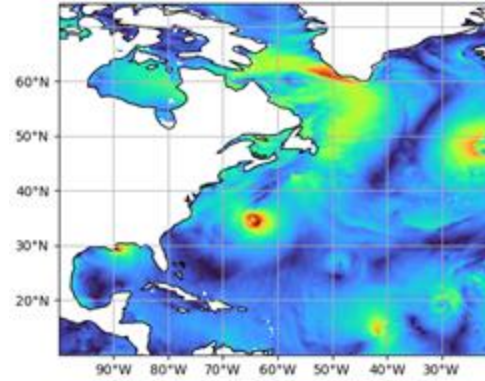
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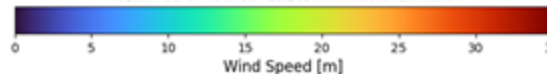
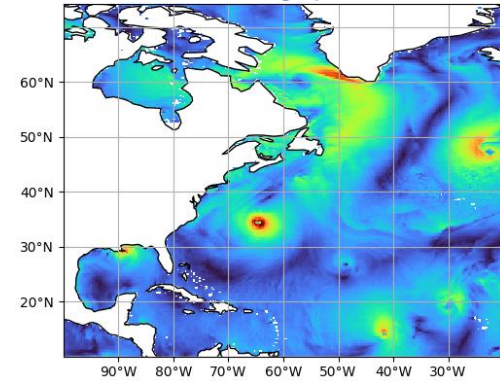
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HR2



HR3b

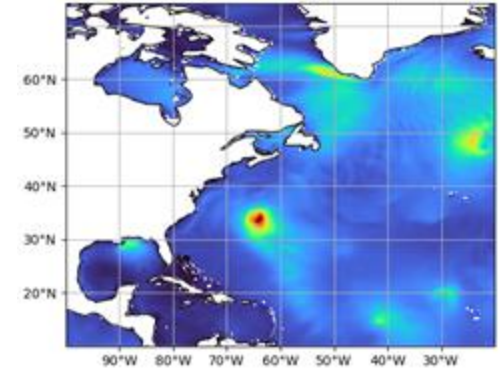
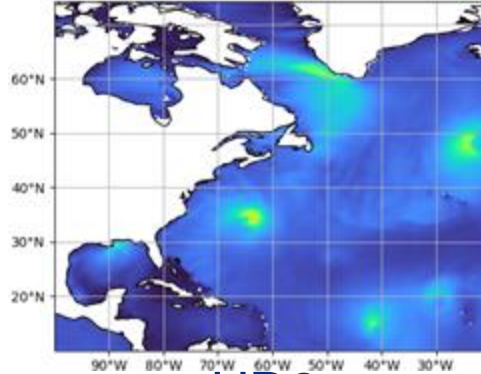
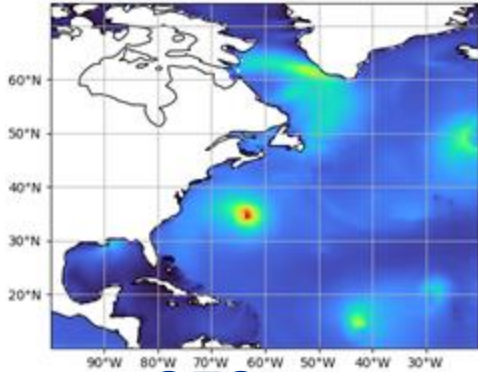


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muli_1

HR1

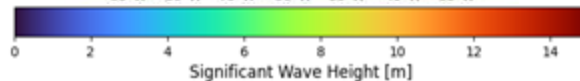
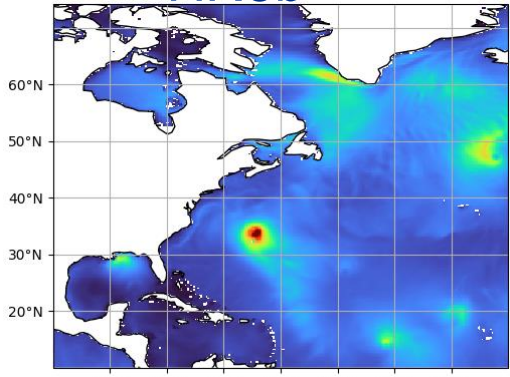
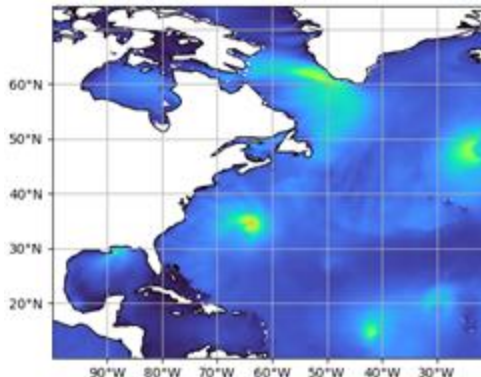
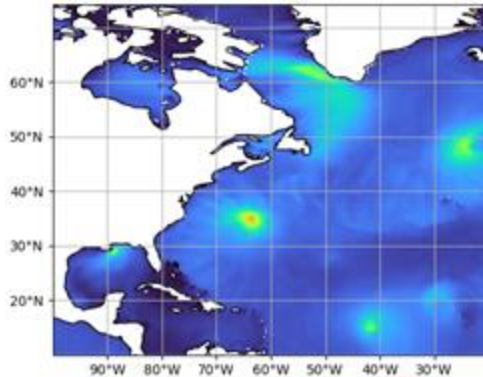
HR3a



GFSv16

HR2

HR3b

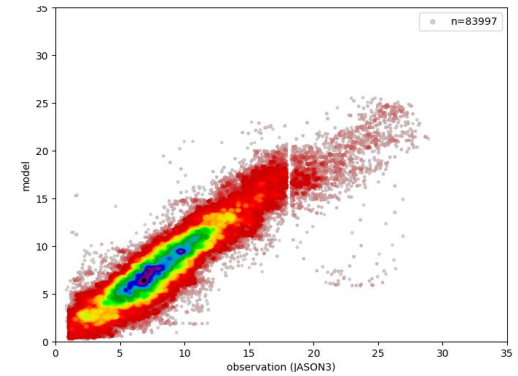
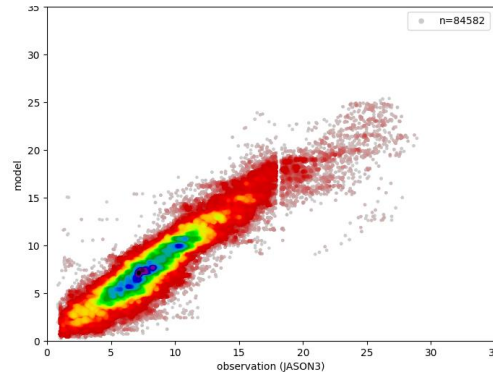
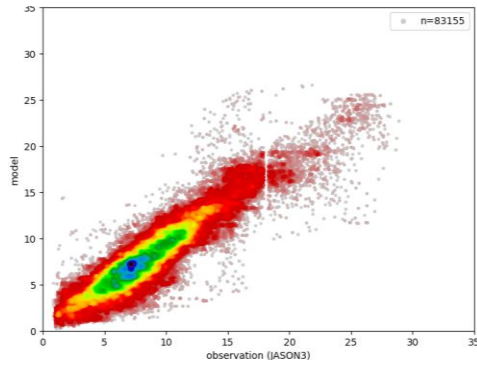


Wind Speed 20200913 00z Day 2

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HR1

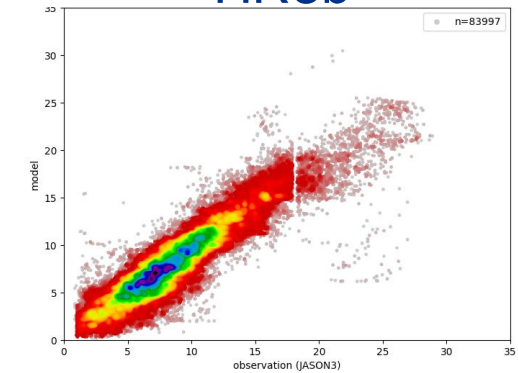
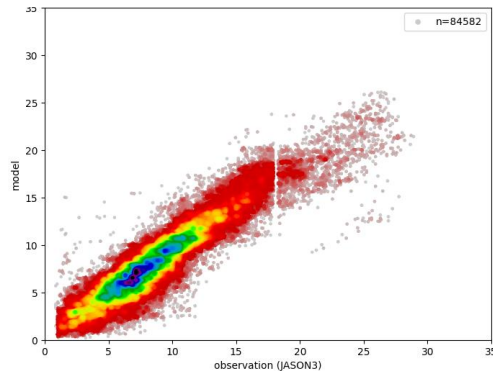
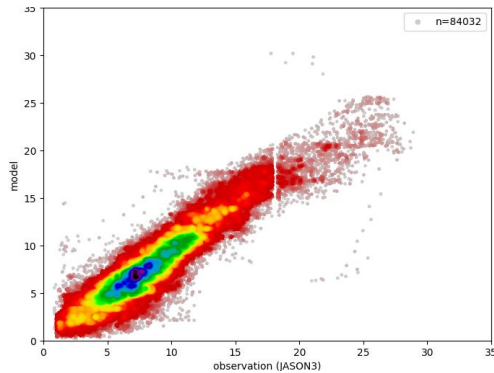
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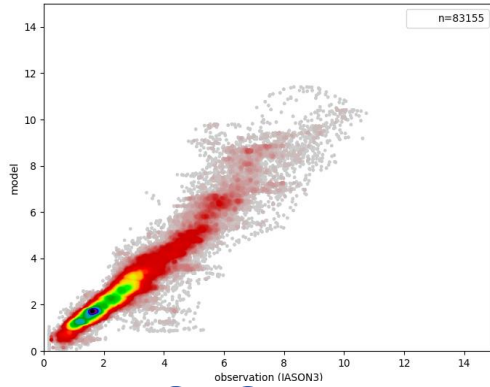
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HR3b

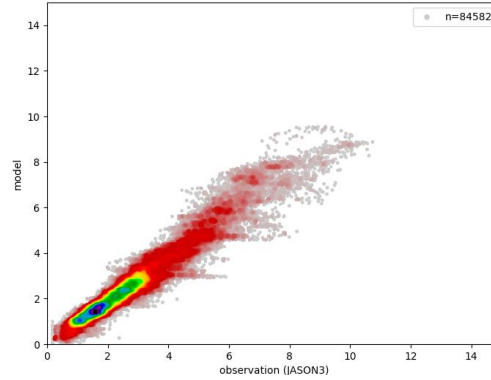


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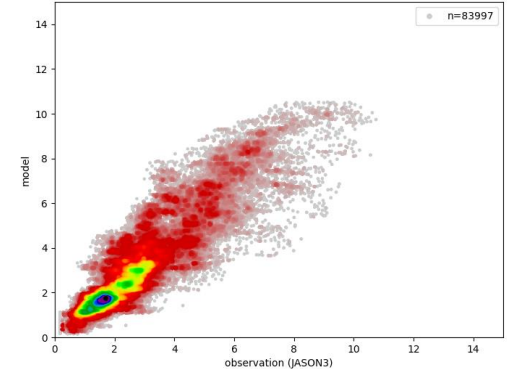
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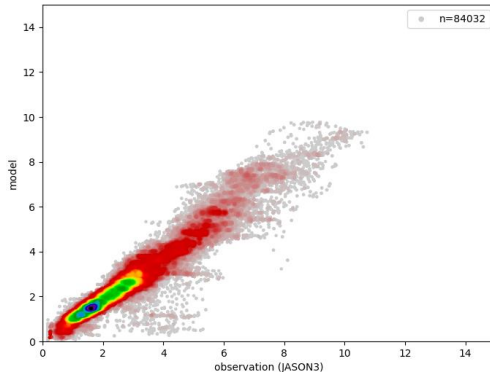
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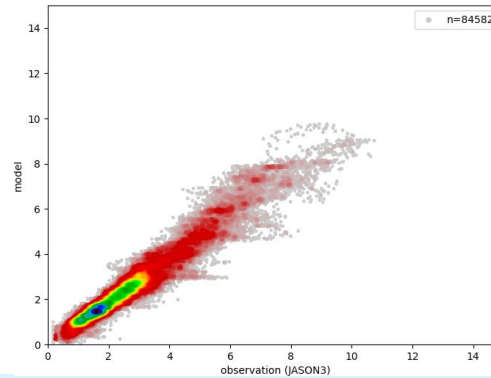
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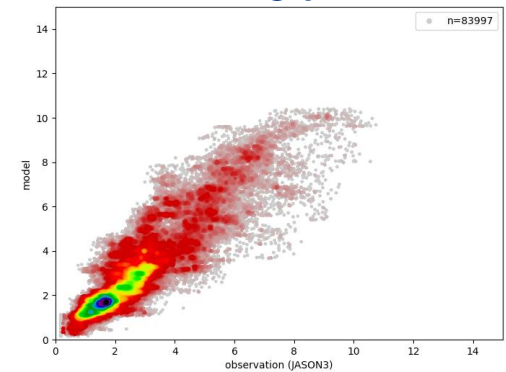
GFSv16



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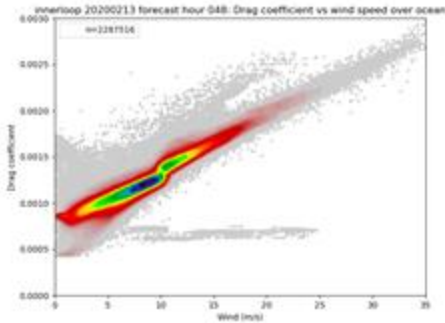
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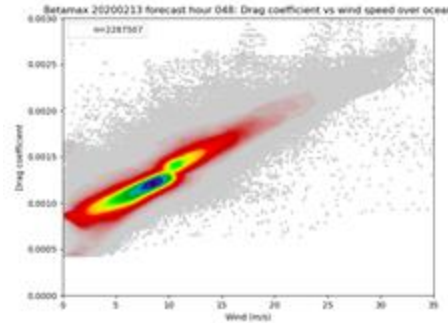
Future Work

- Continued development of unstructured grids for GFSv17
 - Create final grid
 - Optimize computational performance
 - Improve wave model skill
- Examining ways to improve the wave-feedback to the atmospheric model

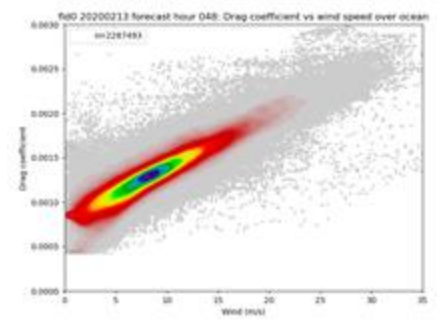
Inner-Loop



Increase Beta Max



FLD0



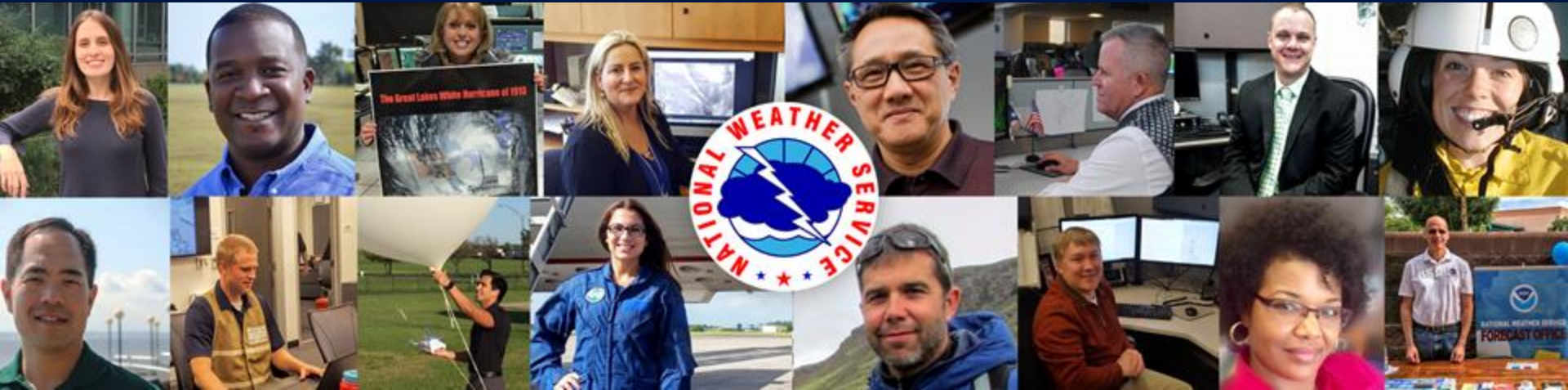


Questions

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Thank you!



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