Hurricane Analysis and Forecast System Development: Future Priorities

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Acknowledgements

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HAFS Development Approach

UFS-R2O Project and its applications follow the same approach:

- Develop innovations into operations
- Ensure lower Readiness Level (RL) research in the R2O pipeline
- Leverage other research and development programs and projects
- Transfer high RL research into operations
## HAFS Development Priorities: After 2023 IOC

### Moving nest
- Multiple storms
- Flexible nesting refinement
- Mass adjustment for fine topography consistency in blending zones
- Code optimization

### Data assimilation
- New data ingestion
- Self-cycled DA
- Weakly Atmosphere/Ocean coupled DA
- JEDI transition

### Ensemble capabilities
- Stochastic physics ensemble capability
- Ensembles on the Cloud (HERC project)

### Physics
- PBL for TC application
- NOAH-MP transition and evaluation
- CP upgrade, transition, & evaluation
- Microphysics parameterization upgrade

### Ocean and wave model transition
- HYCOM to MOM6 transition

### Products
- Ensemble products
- Product fidelities
- 7-day forecast products

### Workflow
- Improve efficiency
- Add more research options
HAFS Development Priorities: Future Innovations

- **Moving nest**
  - Global moving nest
  - Telescopic moving nest for LES capability

- **Data assimilation**
  - AI/ML technology for DA
  - Atmosphere/Ocean coupled DA: strongly vs. weakly
  - All-sky radiances: CRTM vs. RRTMG
  - New DA methodology: scale-aware, particle filter, etc.
  - DA and physics parameterizations interaction
HAFS Development Priorities: Future Innovations

- **Observations**
  - New observations
  - Observation strategy

- **Ensemble**
  - Initial condition perturbation
  - Ensemble for DA
  - Ensembles on the Cloud (HERC project)

- **Physics**
  - AI/ML for physics parameterizations
  - Sub-kilometer physics
  - Physics interactions

- **Ocean-Wave-Atmosphere coupling**
  - Three-way coupling
  - Coupling strategy
  - Ocean and wave model physics
  - Ocean and wave model initialization
Telescopic Nest Capability

HAFS Storm-Focused Domain

- ATM Parent
- ATM Nest
- HYCOM/MOM6 Ocean
- WWIII Wave
Multiple Moving Nest Capability

HAFS Basin-Focused Domain

- ATM Parent
- ATM Nest
- HYCOM/MOM6 Ocean
- WWIII Wave
## HAFS Release Activities in FY24

<table>
<thead>
<tr>
<th>Task #</th>
<th>Activity</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Multi-platform support (Cloud, RDHPCS, and External HPCS)</td>
<td>Ongoing</td>
</tr>
<tr>
<td>2</td>
<td>Scientific documentation</td>
<td>In preparation</td>
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<tr>
<td>3</td>
<td>User’s guide</td>
<td>In preparation</td>
</tr>
<tr>
<td>4</td>
<td>Tutorial and workshop</td>
<td>TBD</td>
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<tr>
<td>5</td>
<td>Code repository management</td>
<td>Ongoing</td>
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<tr>
<td>6</td>
<td>Special issue in Frontiers in Earth Science (Submission QR code: <img src="" alt="QR Code" />)</td>
<td>January 18, '24</td>
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<tr>
<td>7</td>
<td>Help desk</td>
<td>TBD</td>
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<tr>
<td>8</td>
<td>Public Release</td>
<td>TBD</td>
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### Acknowledgement of ALL Active HAFS Developers

<table>
<thead>
<tr>
<th>Atmospheric model dynamics/configurations/workflow</th>
<th>Ocean/Wave coupling through CMEPS</th>
<th>Data Assimilation</th>
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</thead>
<tbody>
<tr>
<td><strong>NCEP/EMC</strong> Avichal Mehra, Zhan Zhang, Bin Liu, Dusan Jovic, JungHoon Shin, Vijay Tallapragada, Biju Thomas, Jun Wang</td>
<td><strong>NCEP/EMC</strong> Maria Aristizabal, Matthew Masarik, Jessica Meixner, John Steffen</td>
<td><strong>NCEP/EMC</strong> Li Bi, Yonghui Weng, Ting Lei, Shun Liu, Daryl Kleist</td>
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<tr>
<td><strong>AOML/HRD</strong> Xuejin Zhang, Ghassan Alaka, S. Gopalakrishnan, William Ramstrom</td>
<td><strong>AOML/HRD</strong> Lew Gramer</td>
<td><strong>AOML/HRD</strong> Jason Sippel, Sarah D. Ditchek</td>
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<td><strong>DTC</strong> Kathryn Newman, Mrinal Kanti Biswas, Linlin Pan</td>
<td><strong>AMOL/PhOD</strong> Hyun-Sook Kim</td>
<td><strong>OU</strong> Xu Lu, Xuguang Wang</td>
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<tr>
<td><strong>GFDL</strong> Rusty Benson, Lucas Harris, Joseph Mouallem</td>
<td><strong>ESMF</strong> Rocky Dunlap, Dan Rosen, Gerhard Theurich, Ufuk Turuncoglu,</td>
<td><strong>UM/CIMAS</strong> Altug Aksoy, Dan Wu</td>
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<tr>
<td><strong>Model Pre- and Post-processes</strong></td>
<td><strong>Atmospheric Physics</strong></td>
<td><strong>Verification/Evaluation</strong></td>
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<tr>
<td><strong>NCEP/EMC</strong> George Gayno, Hui-Ya Chuang, Bantwale Enyew, Qingfu Liu, Chuan-Kai Wang, Wen Meng, Lin Zhu, Rahul Mahajan</td>
<td><strong>NCEP/EMC</strong> Jongil Han, Ruiyu Sun, Xu Li, Chunxi Zhang, Weiguo Wang, Fanglin Yang</td>
<td><strong>NCEP/EMC</strong> Olivia Ostwald, Jiayi Peng, Hui Ya Chuang</td>
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<td><strong>GFDL</strong> Timothy Marchok</td>
<td><strong>AOML/HRD</strong> Andrew Hazelton, Xuejin Zhang</td>
<td><strong>NHC</strong> Michael Brennan, Jon Martinez, Ben Trabing, David Zelinsky, Wallace Hogsett</td>
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<td><strong>NHC</strong> Michael Brennan, Jon Martinez, Ben Trabing, David Zelinsky, Wallace Hogsett</td>
<td><strong>UAH</strong> Xiaomin Chen</td>
<td><strong>JTWC</strong> Brian Strahl, Levi Cowan</td>
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<td><strong>UMD</strong> Joseph Alan Knisely, Kenta Kurosawa, Jonathan Poterjoy</td>
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<td><strong>SUNY/U at Albany</strong> Ryan Torn, Eun-Gyeong Yang</td>
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<td>Majority of the development supported through FY18/FY19/FY22 HSUP/DSUP, JTTI, and UFS-R2O Projects</td>
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