FY18 NGGPS Competition

This is the Round 3 of Research to Operations (R2O) Initiative that supports the development of the Next Generation Global Prediction System (NGGPS) at global and regional scales (see details in NOAA-NWS-NWSPO-2018-2005325).

The priorities for the NGGPS competition include a) advancements in data assimilation techniques for atmosphere, land surface, ocean and waves, preferably in the context of the Joint Effort for Data assimilation Integration (JEDI) effort of the Joint Center for Satellite Data Assimilation (JCSDA); b) advancement in representation of atmospheric model physical processes through coupling with land surface, ocean, waves, sea ice and aerosols. c) advancements in ensemble development; d) advances in post-processing; e) advancements in verification methods; f) Weeks 3-4 forecast products.

For the NGGPS competition, 12 proposals were awarded with individual award amounts ranging from $100,000 to $200,000 per year for up to two years. Project start date is September 1, 2018. Details of the projects are summarized in the table below.

Project Title	PI/co PIs	Affiliation
Use of Satellite Data to Evaluate the Connections between the Radiation, Cumulus Convection, and Microphysics Parameterization Schemes and Their Scale Sensitivity for FV3- GFS	Shaowu Bao	Coastal Carolina
Advancing 4D-Variational Ocean Data Assimilation capabilities at NCEP	James Carton Steve Penny	University of Maryland
	Steve Penny	NOAA/PSL & CIRES
Development and Application of Microphysics Specific and Distribution Consistent Microwave Radiance Forward Models (CRTM) for the NGGPS-FV3 mOdel under the JEDI Framework	Eugene Clothiaux Xingchao Chen	Pennsylvania State University
Using Process-Oriented Diagnostics with Feature-based Verification Software to Improve Models	Brian Colle	Stony Brook University
	Paul Kuchera Tara Jensen	NCAR
Sub-Grid Cloud Overlap and Radiation Coupling Enhancements for NGGPS Global Weather Predictions	Michael Iacono	Atmospheric & Environmental Research
Improving Week 3-4 Weather Prediction Through a Global Convection-Allowing Version of the NOAA Unified Coupled Modeling Framework	Jim Kinter	George Mason University
	Shian-Jiann Li	NOAA/GFDL
	Vijay Tallapragada	NOAA/EMC
Continued Assimilation and Enhancement of the Blended High-Resolution Snow Depth Analysis into NWP Models for Global/Regional Applications	Cezar Kongoli	University of Maryland
Improving Cloud Processes in the NCEP Global Models	Steven Krueger	University of Utah
	David Randall	Colorado State University
Convection-Permitting Subseasonal Global Prediction: Evaluation for Operational Application in NOAA	Cliff Mass	University of Washington
The Impact of Ocean Resolution in the Unified Forecast System (UFS) on the Subseasonal Forecast of Extreme Hydrological Events	Cristiana Stan	George Mason University
Scale-dependent Covariance Localization for FV3GDAS 4DEnVar Data Assimilation System to Improve Global and Hurricane Predictions	Xuguang Wang	University of Oklahoma
The Unified Gravity Wave Physics in the Vertically Extended Atmosphere Models of NGGPS: Resolution-aware Coupling and Verification with FV3 Dynamical Core	Valery Yudin Timothy Fuller-Rowell Joseph Schoonover	University of Colorado

Publications

Bao

Bao, S., Bernardet, L., Thompson, G., Kalina, E., Newman, K. and Biswas, M., 2020. Impact of the Hydrometeor Vertical Advection Method on HWRF's Simulated Hurricane Structure. Weather and Forecasting, 35(2), pp.723-737. https://doi.org/10.1175/WAF-D-19-0006.1.

Carton

Lin, H.-Y., S.G. Penny, 2021: Fourier Reservoir Computing for data-driven prediction of multi-scale coupled quasi-geostrophic dynamics. Geophys. Res. Lett., (submitted).

Platt, J.A., A.S. Wong, R. Clark, S.G. Penny, H.D.I. Abarbanel, 2021: Forecasting Using Reservoir Computing: The Role of Generalized Synchronization. Submitted to Phys. Rev. E., Available in preprint: https://arxiv.org/abs/2103.00362
Boukabara et al., 2021, in press.

Clothiaux

Chen, X., Nystrom, R.G., Davis, C.A. and Zarzycki, C.M., 2021. Dynamical Structures of Cross-Domain Forecast Error Covariance of a Simulated Tropical Cyclone in a Convection-Permitting Coupled Atmosphere–Ocean Model. Mon. Wea. Rev., 149(1), pp.41-63. https://doi.org/10.1175/MWR-D-20-0116.1

Chen, X. and Zhang, F., 2019. Development of a convection-permitting air-sea-coupled ensemble data assimilation system for tropical cyclone prediction. J. Adv. Model. Earth Sys., 11(11), pp.3474-3496. https://doi.org/10.1029/2019MS001795

Hartman, C.M., Chen, X., Clothiaux, E.E. and Chan, M.Y., 2021. Improving the Analysis and Forecast of Hurricane Dorian (2019) with Simultaneous Assimilation of GOES-16 All-Sky Infrared Brightness Temperatures and Tail Doppler Radar Radial Velocities. Mon. Wea. Rev., 149(7), pp.2193-2212. https://doi.org/10.1175/MWR-D-20-0338.1

Nystrom, R.G., Greybush, S.J., Chen, X. and Zhang, F., 2021. Potential for new constraints on tropical cyclone surface-exchange coefficients through simultaneous ensemble-based state and parameter estimation. Mon. Wea. Rev., 149(7), pp.2213-2230. https://doi.org/10.1175/MWR-D-20-0259.1

Zhang, Y., Chen, X. and Lu, Y., 2021. Structure and Dynamics of Ensemble Correlations for Satellite All-Sky Observations in an FV3-Based Global-to-Regional Nested Convection-Permitting Ensemble Forecast of Hurricane Harvey. Mon. Wea. Rev., https://doi.org/10.1175/MWR-D-20-0369.1

Colle

Leonardo, N.M., and B.A. Colle, 2021: An investigation of large cross-track errors in North Atlantic tropical cyclone GEFS ensemble forecasts. Mon. Wea. Rev., 149, 395-417. https://doi.org/10.1175/MWR-D-20-0035.1

Leonardo, N.M., and B.A. Colle, 2020: An investigation of large along-track errors in North Atlantic tropical cyclone ECMWF ensemble forecasts. Mon. Wea. Rev., 148, 457-476. https://doi.org/10.1175/MWR-D-19-0044.1.

Kinter

Duan, Y., S. Kumar, & J. L. Kinter, 2021: Evaluation of long-term temperature trend and variability in CMIP6 multimodel ensemble. Geophys. Res. Lett., 48, e2021GL093227. https://doi.org/10.1029/2021GL093227

Gaal, R. and J. L. Kinter 2021: Soil Moisture Influence on the Incidence of Summer Mesoscale Convective Systems in the U.S. Great Plains. Mon. Wea. Rev. (submitted).

Manganello, J. and J. L. Kinter, 2021: Modulation of Mid-Atlantic Tropical Cyclone Landfalls by the MJO. Geophys. Res. Lett. (submitted).

Shukla, R., B. Huang, C.-S. Shin, and J. L. Kinter III, 2021: Predictability of ENSO. J. Climate (submitted).

Singh, B. and J. L. Kinter, 2020: Tracking of Tropical Intraseasonal Convective Anomalies: Part 1: Seasonality of the Tropical Intraseasonal Oscillations. J. Geophys. Res., 125, https://doi.org/10.1029/2019JD030873.

Kongoli

Gan, Y, Y. Zhang, C. Kongoli, C. Grassotti. Y-K, Yong, 2021, Evaluation and blending of ATMS and AMSR2 snow water equivalent retrievals over the conterminous United States, Remote Sensing of Environment 254, https://doi.org/10.1016/j.rse.2020.112280.

Kongoli, C, J. Key and T. Smith, 2019. Mapping of snow depth by blending in-situ and satellite data using two dimensional optimal interpolation – Application to AMSR2. Remote Sensing, 11(24), 3049; https://doi.org/10.3390/rs11243049

Kongoli, C, J. Key and T. Smith, 2019. Evaluation of a global snow depth analysis based on optimal interpolation, International J. Ecosys. Ecol. Sci., Volume 9, issue 4, 2019, 831-836 https://www.ijees.net/images/pdf/CezarKongoli12TomasSmith2EVALUATIONOFAGLOBALSNOWDEPTHANALYSISBASEDONOPTIMALINTERPOLATIONpage831-836;-d61cd56415.pdf.

Kongoli, C. and T. Smith. 2021, Northern hemispheric snow depth distribution using optimal interpolation, International J.Ecosys. Ecology Sci., 11(3), https://doi.org/10.3390/rs11243049.

Krueger

Randall, D. A., S. K. Krueger, and D. A. Dazlich, 2021: Organic convection. In preparation for the Journal of Advances in Modeling the Earth System. Draft manuscript available on request.

Mass

Mass, C. F., Conrick, R., Weber, N., & Zagrodnik, J. P. (2019). The Quinault Blowdown: A Microscale Wind Event Driven by a Mountain-Wave Rotor, Bull. Amer. Meteor. Soc., 100(6), 977-986. https://doi.org/10.1175/BAMS-D-18-0232.1.

Weber, N. J., Kim, D., & Mass, C. F. (2021). Convection–Kelvin Wave Coupling in a Global Convection-Permitting Model, J. Atmos. Sci., 78(4), 1039-1055. https://doi.org/10.1175/JAS-D-20-0243.1.

Weber, N., D. Kim, and C. Mass, 2020: Convectively coupled Kelvin waves in a global convection-permitting model. J. Atmos. Sci,. 78, 1039-1055. https://doi.org/10.1175/JAS-D-20-0243.1.

Weber, N. J., Mass, C. F., & Kim, D. (2020). The Impacts of Horizontal Grid Spacing and Cumulus Parameterization on Subseasonal Prediction in a Global Convection-Permitting Model, Mon. Wea. Rev., 148(12), 4747-4765. https://doi.org/10.1175/MWR-D-20-0171.1.

Weber, N. J., & Mass, C. F. (2019). Subseasonal Weather Prediction in a Global Convection-Permitting Model, Bull. Amer. Meteor. Soc., 100(6), 1079-1089. https://doi.org/10.1175/BAMS-D-18-0210.1.

Weber, N. J., & Mass, C. F. (2017). Evaluating CFSv2 Subseasonal Forecast Skill with an Emphasis on Tropical Convection, Mon. Wea. Rev., 145(9), 3795-3815. https://doi.org/10.1175/MWR-D-17-0109.1.

Stan

Krishnamurthy, V., J. Meixner, L. Stefanova, J. Wang, D. Worthen, S. Moorthi, B. Li, T. Sluka, C. Stan, 2021: Sources of subseasonal predictability over CONUS during boreal summer, J. Climate, 34, 3273-3294. https://doi.org/10.1175/JCLI-D-20-0586.

Wang

Huang, B., , X. Wang, D. Kleist, and T. Lei, 2020: A Simultaneous Multi-scale Data Assimilation using Scale Dependent Localization in GSI-based Hybrid 4DEnVar for NCEP FV3-based GFS. Mon. Wea. Rev., https://doi.org/10.1175/MWR-D-20-0166.1.

Yudin

van Niekerk, A., I. Sandu, , A. Zadra, E. Bazil, T. Kanehama, M. Köhler, M. Toy, S. Vosper, and V. Yudin (2020). COnstraining ORographic Drag Effects (COORDE): a model comparison of resolved and parametrized orographic drag. J. Adv. Model. Earth Sys., 12, https://doi.org/10.1029/2020MS002160.

Presentations

Bao

Novak, K. and Bao, S., 2019. Evaluation of FV3 Model Using Satellite Brightness Temperature Data. In AGU Fall Meeting, San Francisco, CA, 9-13 December 2019.

Bao, S and D. Shen: Use Satellite Data to Evaluate the Physics Schemes and Their Scale Sensitivity for FV3-GFS. First Annual UFS Users' Workshop, July 29, 2020.

Colle

Leonardo, N., and B.A. Colle. An Investigation of North Atlantic TC Ensemble Forecasts with Large Cross-Track Errors. 26thh Conference on Numerical Weather Prediction, Amer. Meteo. Soc., Boston, MA, 12-16 January 2020. https://ams.confex.com/ams/2020Annual/meetingapp.cgi/Paper/368622.

Krueger

Krueger, S.K., and M. Khairoutdinvov, 2021: Cold Pools and the Organization of Tropical Convection in Global Cloud-System Resolving Simulations. Workshop on Spatial Organisation of Convection, Clouds and Precipitation, Copenhagen, Denmark, (virtual), 5-7 May 2021.

Krueger, S.K., and M. Khairoutdinov, 2019: Cold pools and the organization of tropical convection in global cloud-system resolving simulations. AGU Fall Meeting 2019, San Francisco, CA, 09-13 December 2019

Krueger, S.K., 2019: Cold pools and the organization of tropical convection in global cloud-system resolving simulations. Workshop on Convection Parameterization: Progress And Challenges, Met Office, Exeter, UK, 15-19 July 2019. (http://sites.exeter.ac.uk/convection-workshop/)

Randall, D., and S. Krueger, 2019: A new framework for convection parameterizations. NGGPS biweekly telecon, December 4, 2019.

Schumacher

Brammer, A., 2020: Using dynamically-based probabilistic forecast systems to improve the National Hurricane Center wind speed probability products. HFIP Annual Meeting (Virtual), 11/19/2020.

Brammer, A., A. Schumacher, and K. Musgrave, 2021: Development of a Multi-model Global Ensemble Based Tropical Cyclone Wind Speed Probability Model. 34th Conference on Hurricanes and Tropical Meteorology (Virtual), 10-14 May 2021.

Brammer, A., A. Schumacher, and K. Musgrave, 2021: Development and Evaluation of a Multimodel Global Ensemble Tropical Cyclone Wind Speed Probability Product. 30th Conference on Weather Analysis and Forecasting (WAF)/26th Conference on Numerical Weather Prediction (NWP), AMS Annual Meeting (Virtual), 13-17 January 2021.

Stan

Stan, C. and V. Krishnamurthy, 2021: Predictability of extreme events in UFS at subseasonal time scale. 11th Conference on Transition of Research to Operations, AMS Annual Meeting, Virtual.

Stan, C. and V. Krishnamurthy, 2021: Predictability of extreme events in UFS at subseasonal time scale. EGU Annual Meeting, Virtual.

Wang

Han, F., X. Wang, J. Feng, 2021: Vertically Extended Scale-Dependent Covariance Localization in GSI-Based Hybrid 4DEnVar for NCEP FV3-Based GFS. AMS Annual Meeting 2021, 25th Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface (IOAS-AOLS).

Huang, B., X. Wang, D. T. Kleist, and T. Lei, 2019: Impact of Scale-Dependent Localization with and without Cross-Band Correlation on Hurricane Track Forecasts in the FV3GFS 4DEnVar System. AMS Annual Meeting, Phoenix.

Wang, X., 2021: “Multiscale data assimilation for numerical weather prediction”, University of Maryland, Atmospheric and Oceanic Science (AOSC) Department, invited seminar.

Wang, X., 2019: “Multi-resolution and multiscale data assimilation in EnVar for global and convective scale NWP”, 100th AGU Fall Meeting, San Francisco, USA, invited talk.

Wang, X., 2019: “Multi-resolution and multiscale data assimilation in hybrid 4DEnVar for global numerical weather prediction”, 27th IUGG General Assembly, Montreal, Canada, invited talk.

Wang, Y. and X. Wang, 2021: Simultaneous Multiscale Data Assimilation in Hybrid EnVar to Improve the Convective Scale. 101st AMS Annual Meeting.

Wang, X., B. Huang, Y. Wang, D. Kleist and T. Lei, 2020: Recent Development of Multiscale and Multiresolution Data Assimilation in Hybrid EnVar for Global and Regional Numerical Weather Prediction. AMS Annual Meeting, Boston.

Wang, X., J. Kay, B. Huang, D. Kleist, and T. Lei, 2018: Development of the hybrid 4DEnVar system with multi-resolution ensemble and multi-scale covariance localization for NCEP global numerical weather prediction. Washington, DC. AGU meeting.

Wang, X., et al. 2018: Development of the GSI-based hybrid 4DEnVar system with multi-resolution ensembles and multi-scale covariance localization for global numerical weather prediction. 8th EnKF Workshop, Montreal, Canada.

Yudin

Yudin V.A. F. Yang, S. Karol, T. Fuller-Rowell, A. Kubaryk, H. Juang, S. Kar, J. Alpert, and Z. Liu,

(2020c): The Unified Gravity Wave Physics in the Vertically Extended Models of NGGPS and UFS. 1st UFS Users’ Workshop. https://dtcenter.org/sites/default/files/events/2020/4-valery-yudin.pdf, July 27, 2020.