

# Global Systems Laboratory

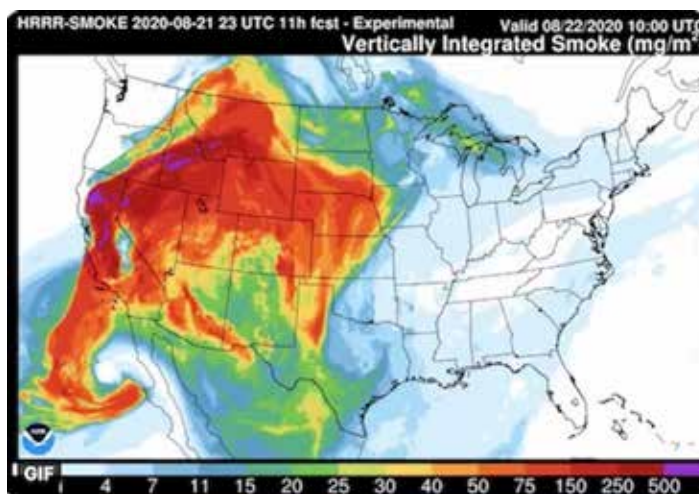
## 2020 Research Highlights



The NOAA Oceanic and Atmospheric Research's Global Systems Laboratory (GSL) does the research to provide the National Weather Service (NWS), the Federal Aviation Administration (FAA), and the public with rapidly-updating environmental models, state-of-the-art decision support tools, innovative visualization systems, and high-performance computing technologies to support commerce and a Weather-Ready Nation.

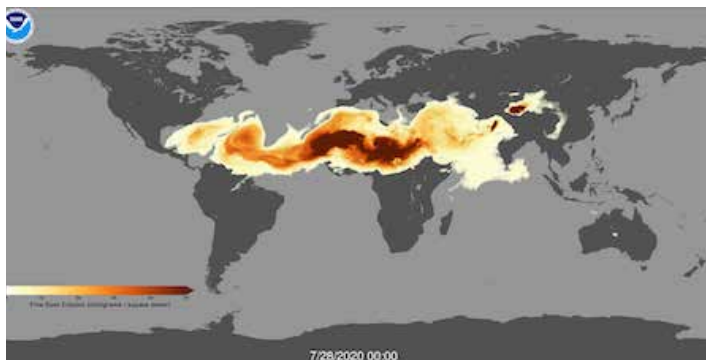
### GSL team successfully transitions significant model upgrades to NWS operations

The final versions of GSL-developed high-resolution weather models -- Rapid Refresh (RAP) and High-Resolution Rapid Refresh (HRRR) were transitioned into NOAA National Weather Service operations on December 2. This latest RAP/HRRR version includes improved forecasts of the upper atmosphere, surface weather, clouds, precipitation, and thunderstorms. Specifically, model upgrades improve forecasts in the Great Lakes region by coupling to a model with lake hydrodynamics. The models also produce wildfire-driven smoke forecasts and predict the impact of smoke on the weather via the HRRR-Smoke module.



### New NOAA research model improves dust, air quality forecasts

One of NOAA's newest models is providing more accurate forecasts of where dust from the Saharan desert will impact air quality. The coupled global weather and chemistry research model, Global Ensemble Forecast System - Aerosols (GEFS-Aerosols), produces seven-day forecasts for a host of air quality impacts, including where dust will deliver hazy days and colorful sunsets, as well as potential breathing problems and other respiratory issues for sensitive populations.



### New research finds reduced observations from commercial aircraft impact regional weather model's accuracy

Flight reductions related to the COVID-19 pandemic raised questions about whether the loss of meteorological observations from aircraft-mounted sensors could affect the accuracy of operational forecast models. A new GSL study, published in the American Meteorological Society's Journal of Applied Meteorology and Climatology, has quantified the impact of these missing observations on the forecasts produced by NOAA's most advanced experimental short-term weather model, the Rapid Refresh (RAP) model.



## GSL's SOS team wins the 2020 Impact Award from the Federal Laboratory Consortium for Technology Transfer

The NOAA GSL's Science on a Sphere (SOS) Explorer™ and SOS Explorer™ Mobile team has been chosen as the 2020 recipient of the Impact Award from the Federal Laboratory Consortium for Technology Transfer (FLC). SOS Explorer™ and SOS Explorer Mobile were developed by a NOAA Global Systems Laboratory team that includes Eric Hackathorn, Hilary Peddicord (CIRES), Beth Russell (CIRES), Jonathan Joyce (CIRES) and Keith Searight (CIRA).



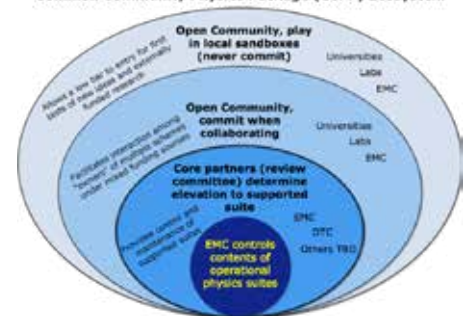
## GSL supports the first UFS release

GSL had a significant role in the first public release of the user-friendly Unified Forecast System (UFS) Medium-Range Weather Application on March 11. This accomplishment took outstanding dedication and cross-agency collaboration. The outstanding work was acknowledged by Neil Jacobs: "The entire UFS team deserves an immense amount of credit. Making global NWP user friendly is beyond challenging."

## The Common Community Physics Package unites the modeling community

Through the Developmental Testbed Center (DTC), GSL and the National Center for Atmospheric Research (NCAR) announced upgraded tools for the modeling community to experiment with and advance physical parameterizations for numerical weather prediction. The goal of CCMPP is to contain parameterizations used in the NOAA Unified Forecast System (UFS) for short-term weather through seasonal prediction timescales, as well as developmental schemes under consideration for upcoming operational implementations. The CCMPP framework is being implemented in several of the U.S. flagship models as a single, standardized way to interface physics with models of the atmosphere (and other components of the Earth system).

Common Community Physics Package (CCPP) Ecosystem

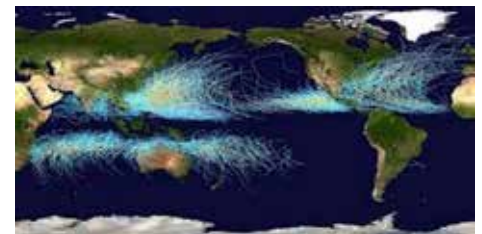


## Hazard Services winter weather capabilities deployed to NWS weather forecast offices

In August, a limited number of NWS Weather Forecast Offices (WFO's) will test and evaluate GSL's Hazard Services Winter Weather Watch/Warning/Advisory (WWA) capabilities. This will be possible through a special version of the software that GSL's Evaluation and Decision Support Division has built and will make available to certain WFO's. This will enable these WFO's to more thoroughly test and evaluate the application in real-time forecast operations.

## The limits of tropical cyclone track prediction

Recent research shows the range of skillful tropical cyclone track forecasts is expected to be extended by a day per decade in the future. The study, by scientists Feifan Zhou from the Chinese Academy of Sciences and Zoltan Toth from NOAA's Global Systems Laboratory, was published in the Bulletin of the American Meteorological Society in September 2020. Two of their key findings are that (1) the true forecast track error (i.e., the difference between forecast position and actual position of tropical cyclones) increases exponentially as a function of forecast days, while (2) initial and forecast errors are reduced exponentially over the years.



## GSL's SOS team offers new educational tours on SOS Explorer™ mobile app

The Global Systems Laboratory's (GSL) Science On a Sphere® (SOS) team has launched educational tours on its free mobile app - SOS Explorer™ (SOSx) - including post-tour exercises for students. You can find the tours here: <https://sos.noaa.gov/education/sosx-tours/>