

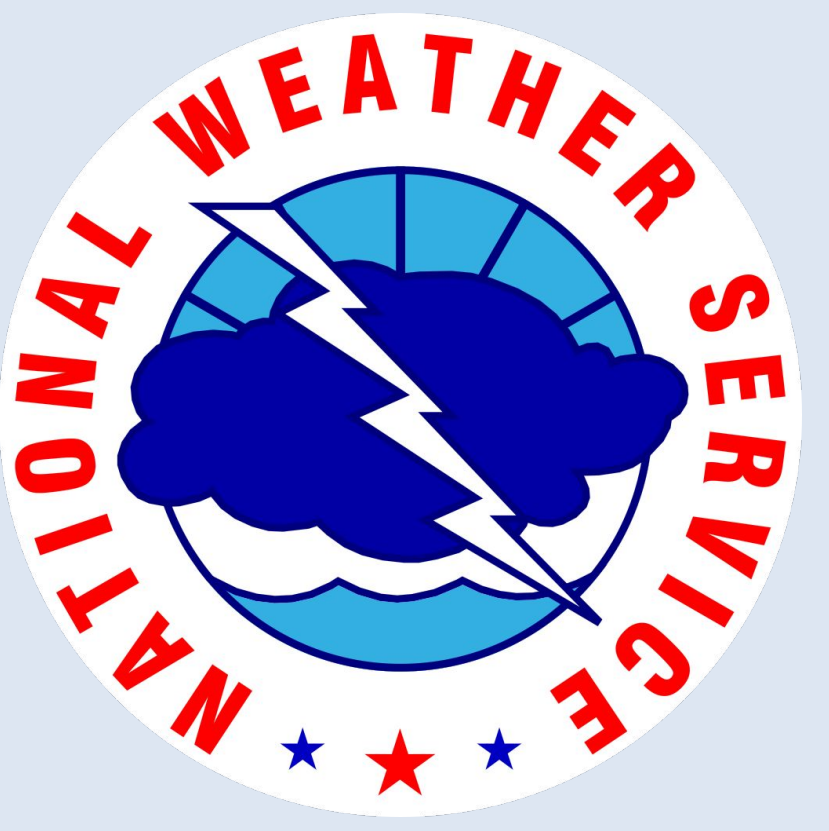


Developing Seasonal Verification in the Environmental Modeling Center (EMC) Verification System (EVS)

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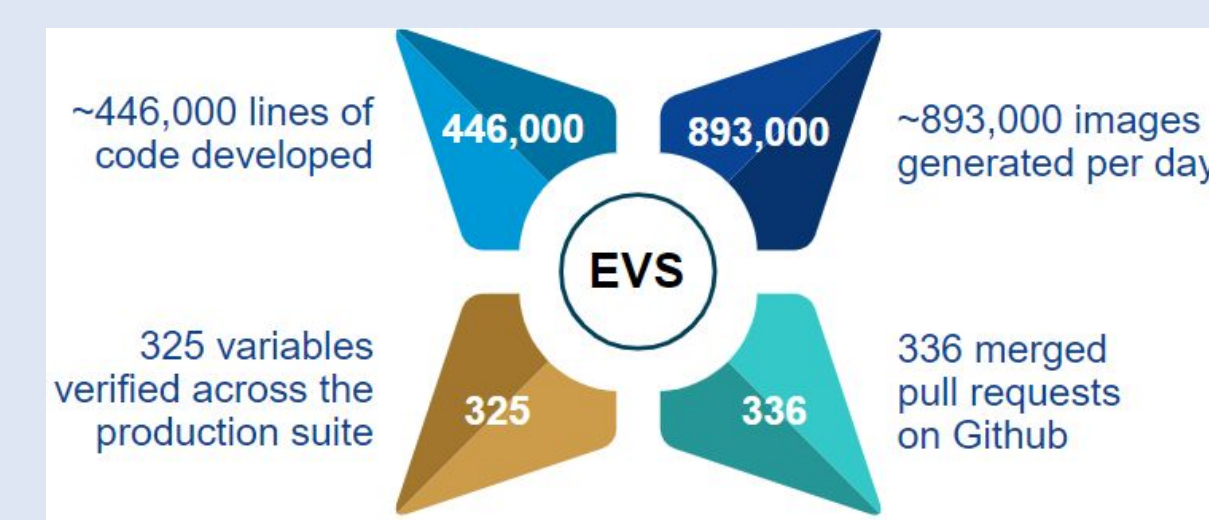
Introduction

- **Seasonal forecasts** are increasingly being requested and utilized for water management, agriculture, energy, insurance, tourism, financial markets etc.
- **Seasonal verification** is critical to **assess models and their performance**

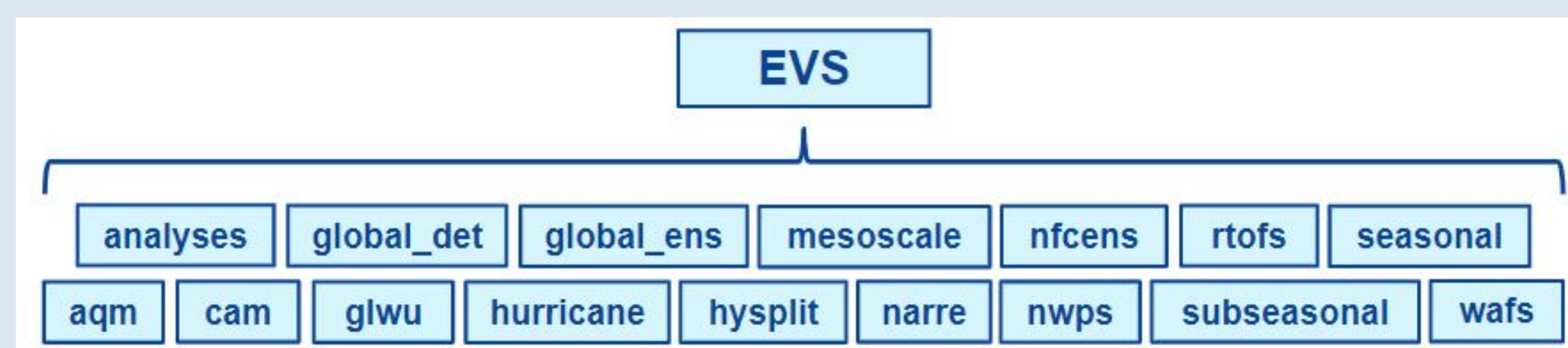


- Seasonal verification timescale: **Month to Year**
- NCEP models that are, or will be, forecasting at this timescale are:
 - **Climate Forecast System version 2 (CFSv2)** - current operational version of the CFS is version 2.3 as of 9 March 2022
 - **Seasonal Forecast System version 1 (SFSv1)** - currently in development
- The Environmental Modeling Center (EMC) has recently created the **EMC Verification System (EVS)** version 1 (EVSv1)

EMC Verification System (EVS) and its Upcoming Seasonal Component



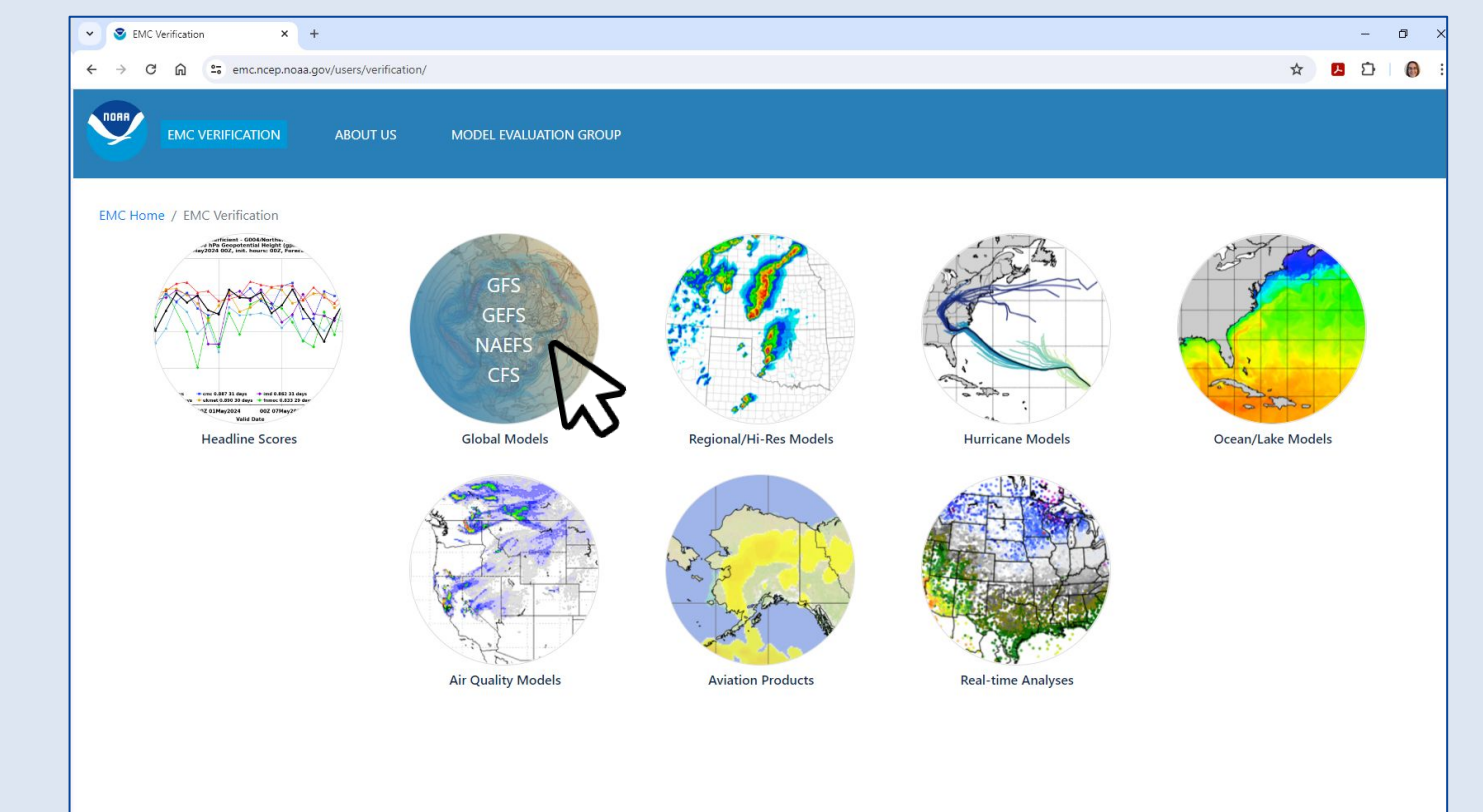
- EVS is used to assess **operational** NCEP model performance
- EVS routinely creates **verification statistics and graphics** in NCEP operations, allowing EMC to monitor operational NCEP model performance in near real time
 - Utilizes the **Model Evaluation Tools (METplus)** software package from DTC



- EVS version 1 is being updated to include a **Seasonal component** whose **verification metrics** will be derived from the 2021 DTC UFS Metrics Workshop
- Temporal resolution of seasonal verification: **Monthly, 3-Monthly**
- Spatial regions of seasonal verification: Tropics, CONUS, Northern Hemisphere (NH), Southern Hemisphere (SH), Arctic, Antarctic, Global etc.
- A total of 30 verification variables have been planned to be included in the Seasonal component of EVS. However, some of them are not included/coded in METplus yet, so the Seasonal component of EVS v2.0 will focus on **~18 verification fields/variables**.

EVS Seasonal Verification: Variables, Statistical Metrics and Validation Data

- **Oceanic Niño Index and SSTs (GHRSSST)**
RMSE, Bias stats for Nino 3.4, NH, SH, Tropics
- **Sea Ice Concentration and Sea Ice Edge (OSI-SAF)**
RMSE, Bias, CSI, Performance diagram, Integrated Ice Edge Error (IIEE) for Arctic, Antarctic
- **OLR and OLR Anomalies (UMD OLR Analyses)**
RMSE, Bias, Anomaly Correlation Coefficient (ACC) for Global and 40N-40S
- **Precipitation and Precipitation Anomalies (CCPA, MRME QPE)**
RMSE, Bias, Equitable Threat Score(ETS), Heidke Skill Score (HSS), Fractional Skill Score (FSS), Performance Diagram for CONUS, Alaska, Hawaii
- **850-hPa Temperature and its Anomalies (GFS Analysis)**
ACC, HSS for NH, SH, Tropics
- **850 and 200-hPa U and V Winds and their Anomalies and 10-hPa Zonal Stratospheric Wind (GFS Analysis)**
RMSE, Bias for NH, SH, Tropics for U/V and 60 N for stratospheric wind
- **500-hPa Geopotential Height and its Anomalies (GFS Analysis)**
RMSE, Bias, ACC, HSS for Tropics, NH, SH
- **Snow Accumulation (NOHRSC)**
HSS for CONUS and CONUS regions



<https://www.emc.ncep.noaa.gov/users/verification/>



.....and more!

Conclusions & Future Planned Capabilities

- Seasonal verification capabilities are being developed as part of **EVS v2.0**
- Will operationally verify CFS forecasts and SFS forecasts (when SFS is operational) and **publish verification graphics on the EMC Verification website**
- Additional fields/variables planned for future include teleconnection indices like NAO index, PNA index, AO index, AAO index, QBO winds, a monsoon index called the East Asian Summer Monsoon index, some drought indices (like SPI, PDSI), and soil variables like soil moisture and soil temperature