IDSS – FAQs

With the goal of enhancing the NWS's mission to save lives and protect property, HEFS products provide a new tool for the WFO forecaster to communicate flood risk. Since we know that all forecasts contain uncertainty, HEFS products are designed to provide a means for expressing uncertainties in streamflow forecasts.

Below are some typical questions that arise:

Q. What types of uncertainty are included in HEFS?

HEFS is capable of handling both meteorological and hydrological modeling uncertainty. Currently all WR RFCs are only leveraging the meteorological uncertainty component of HEFS, which is handled in the Meteorological Ensemble Forecast Processor (MEFP).

Q. How does HEFS handle meteorological uncertainty?

Meteorological uncertainty is determined through a specialized calibration using the MEFP Parameter Estimator (MEFPPE). GEFS (ensemble mean) hindcasts are compared to historical observations of precipitation and temperature, and statistical relationships are used to compute MEFP parameters that translate operational GEFS forecasts into calibrated ensembles specific to each basin. The same procedure can be used to create calibrated ensembles from RFC deterministic forecasts (i.e., short-range QPF), and these can be stitched together (back-to-back in time) with the GEFS-based ensembles within MEFP.

Q. Why does the deterministic forecast differ from the median (or mean) HEFS forecast?

Both forecast systems rely on the same hydrologic models, and are initialized from the same simulated ground conditions (model states). The primary reasons for modeling discrepancies are:

1. Inputs (forcings). HEFS primarily uses GEFS forcings in the short-range (though this can be configured uniquely at each RFC). Most deterministic forecasts are going to be more closely aligned to the NBM, which includes models other than the GEFS. But the different forcings will produce different forecasts.

2. MEFP. As a statistical model built from historical conditions, MEFP forecasts for bigger events can be biased low because they are built from limited information (i.e. bigger events are rarer in the historical record). Additionally, MEFP temperature ensembles can be less dynamic than deterministic temperature forecasts.

Q. Are there differences in how HEFS is applied across Western Region RFC's?

Each RFC may use a different mix of meteorological forcings within the MEFP.

NWRFC = RFC QPF for days 0, GEFS days 1-15, no CFSv2 forcings;
CNRFC = RFC QPF for days 1-3, GEFS days 4-14; no CFSv2 forcings;
CBRFC = RFC QPF for days 0, GEFS days 1-14, no CFSv2 forcings;

Beginning in 2022, all 3 WR RFC's will begin to include the 35-day GEFS extended forecasts into HEFS. While correlations are fairly low at this extended range for precipitation, there is some skill in temperature forecasts into weeks 3 and 4.

Q. Under what conditions are HEFS forecasts less reliable?

Since meteorological uncertainty is currently the only source of HEFS uncertainty, HEFS will be less dependable in uncertain weather patterns. For example:

- Extreme events (due to calibration limitations - few events)
- Mixed rain and snow (precipitation typing challenges)
- Uncertain weather patterns (e.g., convection, cut-off low pressure systems, etc.)
- Regulated river systems (due to reservoir release uncertainties)

Q. How well does HEFS capture extreme events?

By definition, extreme events have a low probability of occurring. MEFP forecasts are statistical forecasts. So bigger events can be biased low because they are built from limited information. MEFP seeks to overcome this tendency with "canonical events" so that correlations between the historical forecasts and observations include more than simple single time-step comparisons, but also include longer time duration events.

Poor performance in large precipitation events is one of the known HEFS deficiencies and is a critical issue identified by the HEFS Gaps Analysis Team. Improvements are expected with additional research.

Q. How well do HEFS projections verify?

RFCs have confirmed HEFS skill through offline hindcasting and validation efforts (i.e. compared to ESP), and are actively pursuing real-time verification of HEFS. We have seen HEFS perform well in many basins under certain conditions, but also struggle in the same and/or other basins under other conditions. HEFS performance is currently basin-specific and condition-specific, but real-time verification of HEFS forecasts may provide forecasters with the knowledge they need to convey more/less confidence in HEFS forecasts during operations.