



Ensemble Forecasts at the OHRFC

Longer-term planning for flooding and drought



Forecasting Rivers Since 1946



Ohio River Forecast Center (OHRFC)

- Daily river forecasts to protect lives and property and promote the economy

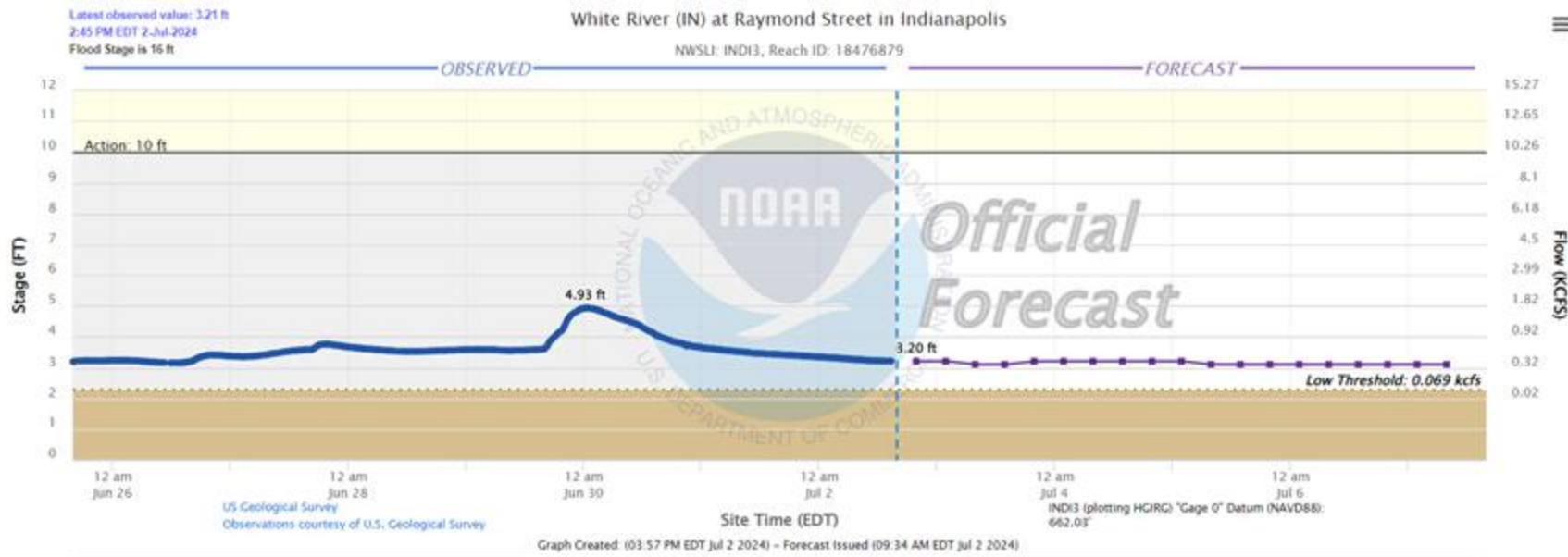


Forecasting Rivers Since 1946



Deterministic Forecasts

- Single value, best estimate, going out 5-10 days into the future with 2-3 days of forecast precipitation

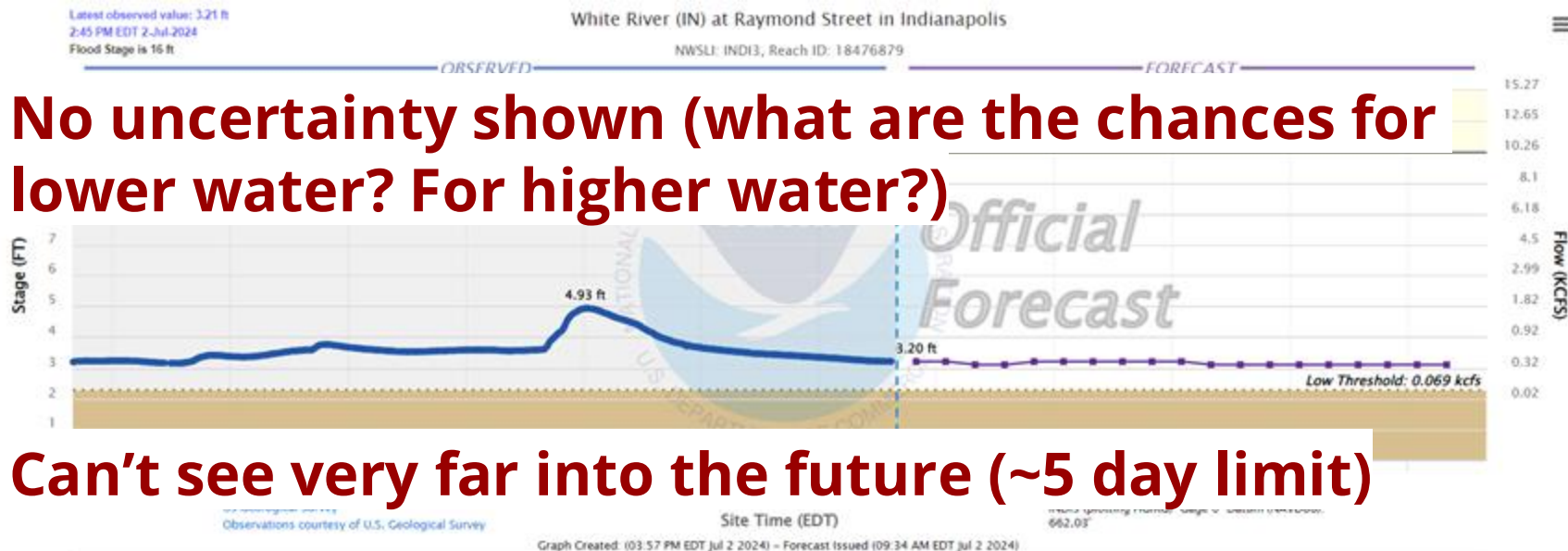


Forecasting Rivers Since 1946



Deterministic Forecasts **Tough to use for drought planning!**

- Single value, best estimate, going out 5-10 days into the future with 2-3 days of forecast precipitation



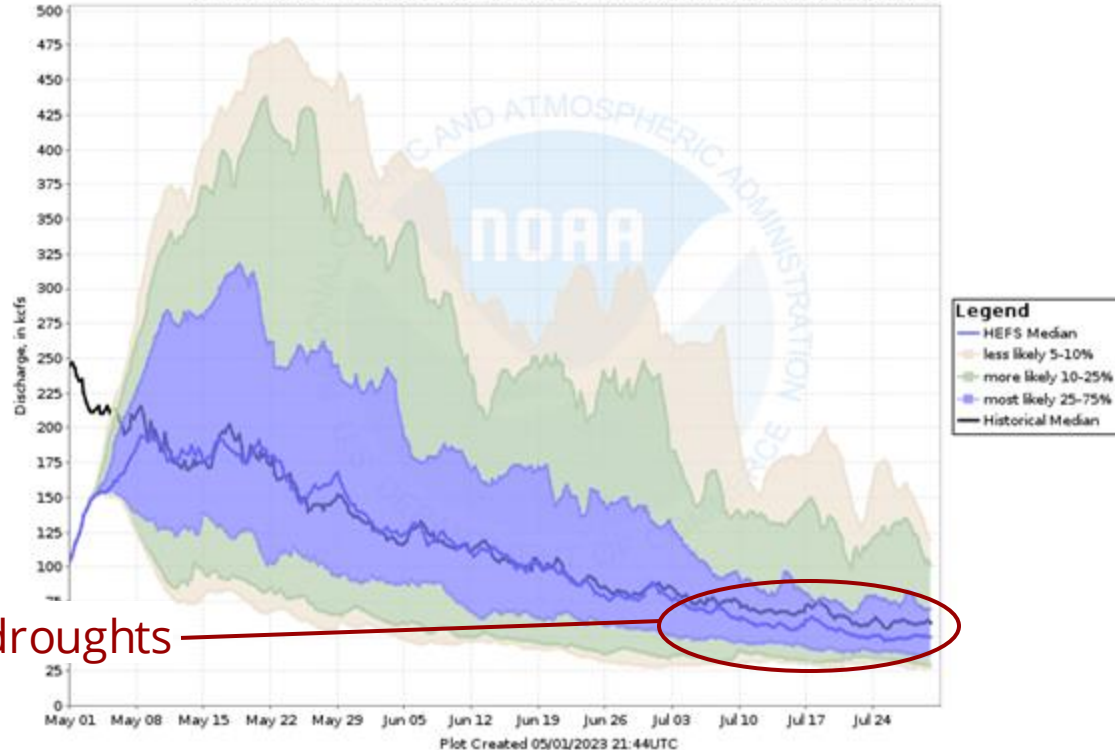
Can't see very far into the future (~5 day limit)

Hydrologic Ensemble Forecast Service



Ohio River at Smithland Lock and Dam, IL (SMLI2)
HEFS Flow Percentiles vs Historical Median
Forecast for the period 05/01/2023 - 07/30/2023

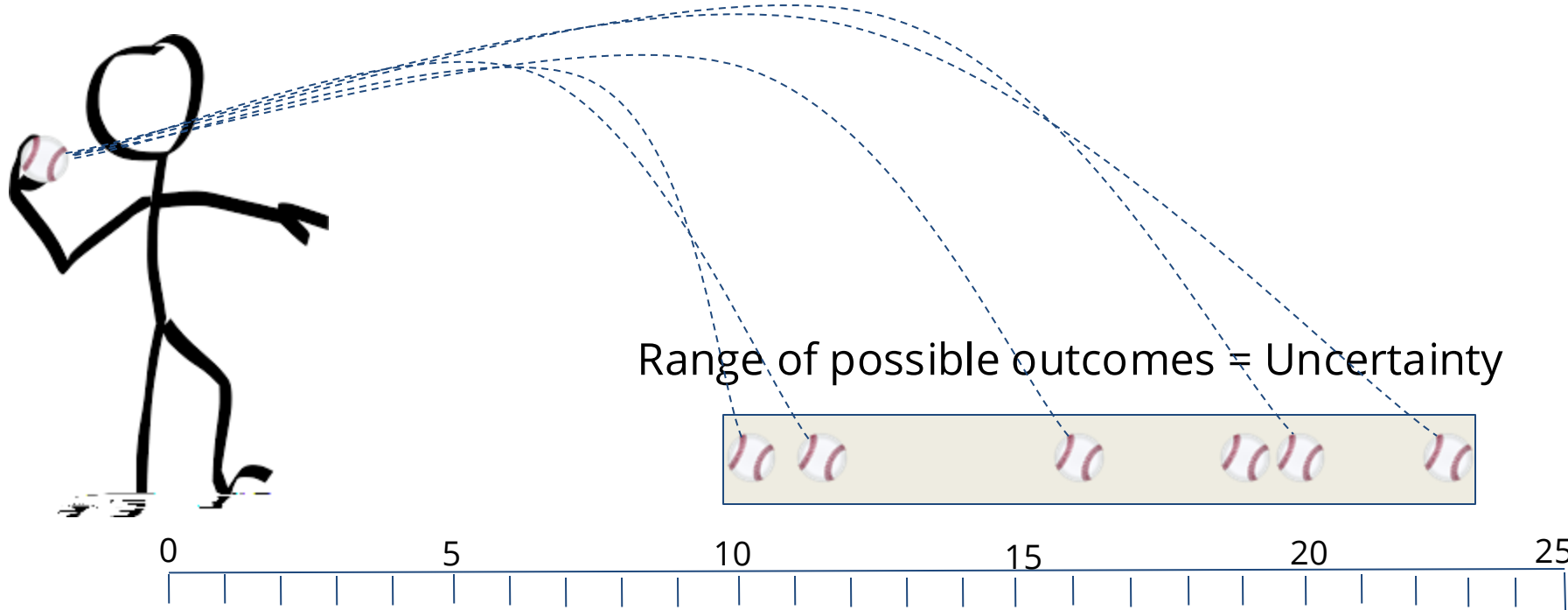
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- Visualize uncertainty and probability
- Look out much further into the future

Early indicator for potential droughts

Uncertainty and Probability

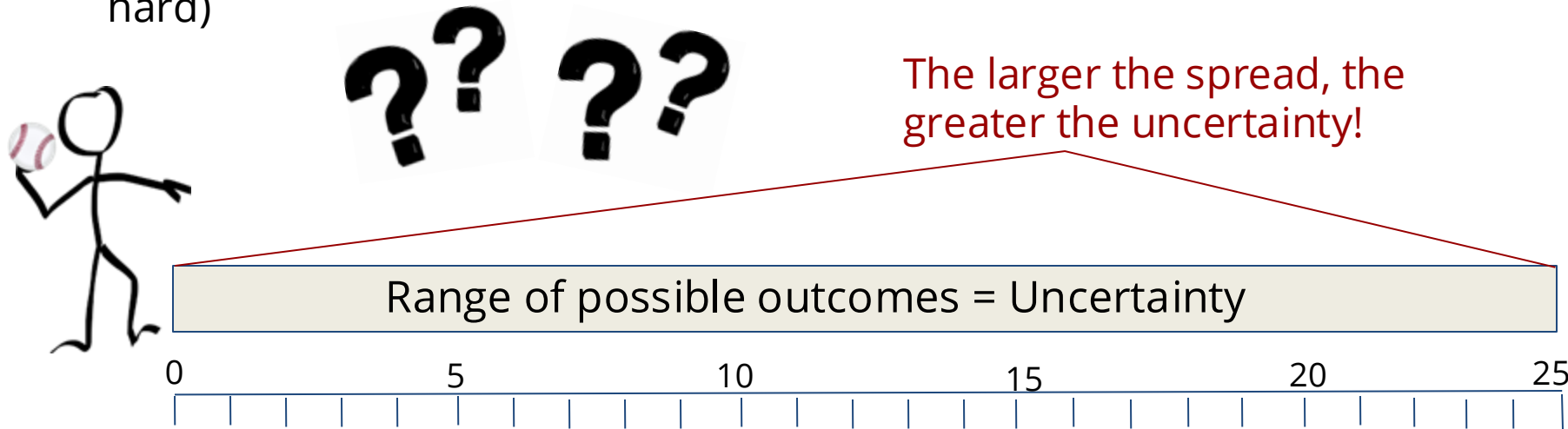


Uncertainty and Probability



What we know:

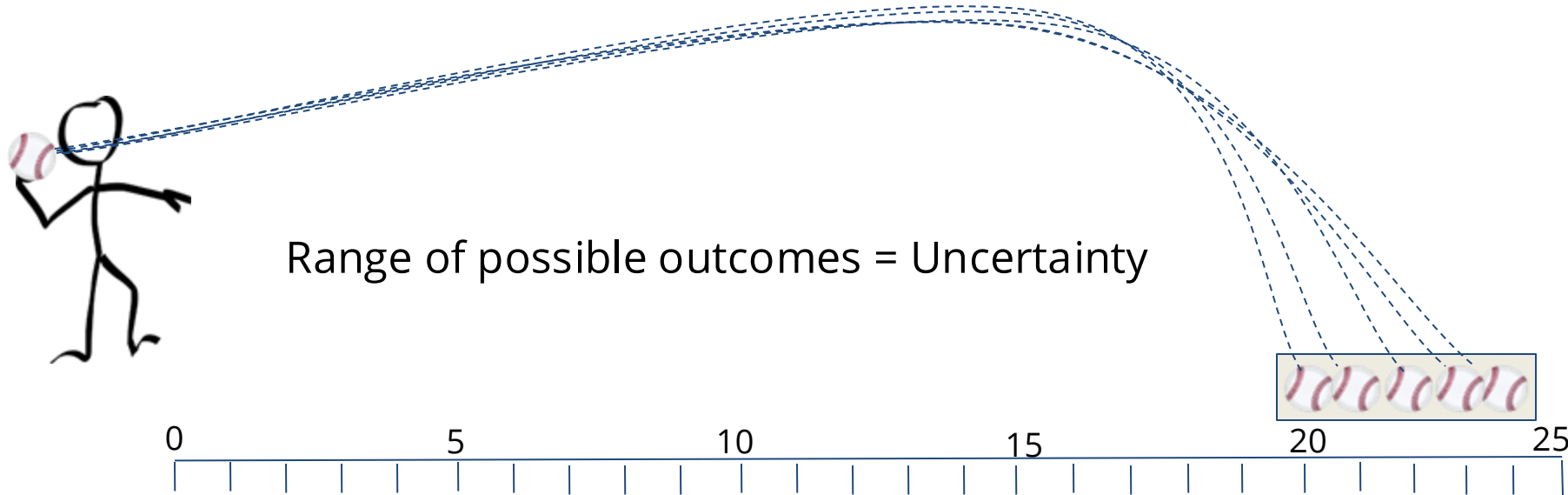
- Stick figure is going to throw the ball (who knows how hard)
- We have never seen this stick figure throw a ball



Uncertainty and Probability

What we know:

- Stick figure plans on throwing the ball as hard as possible
- Stick figure's past hard throws have landed in these locations



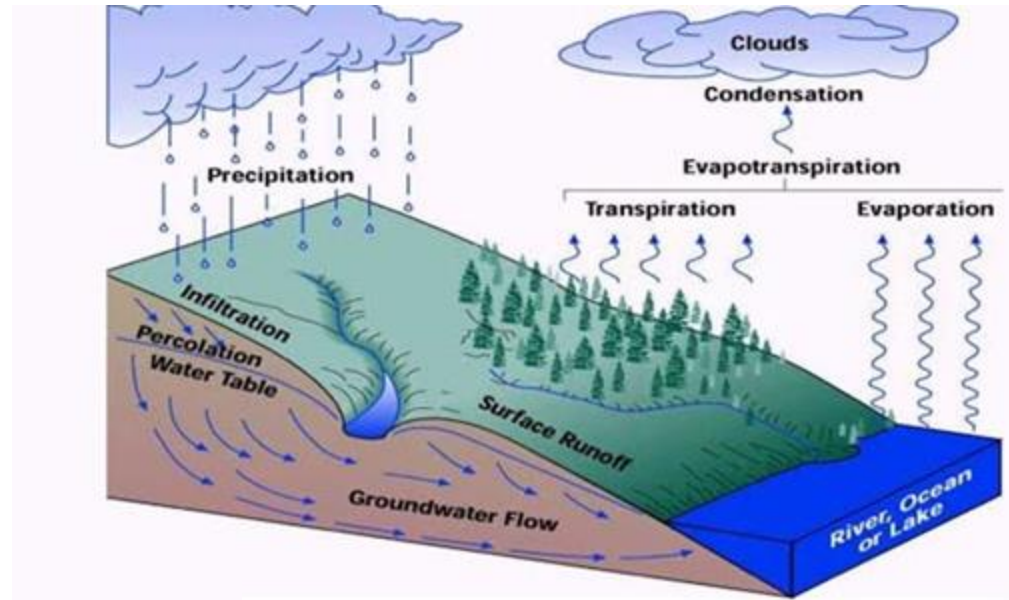
Uncertainty in River Forecasts



Predicting the future **always** involves uncertainty

River forecasting uncertainty

- Weather (rain, snow, snowmelt)!
- How will precipitation or snowmelt act once it is on the surface (infiltration vs runoff)?
- What happens to the river?

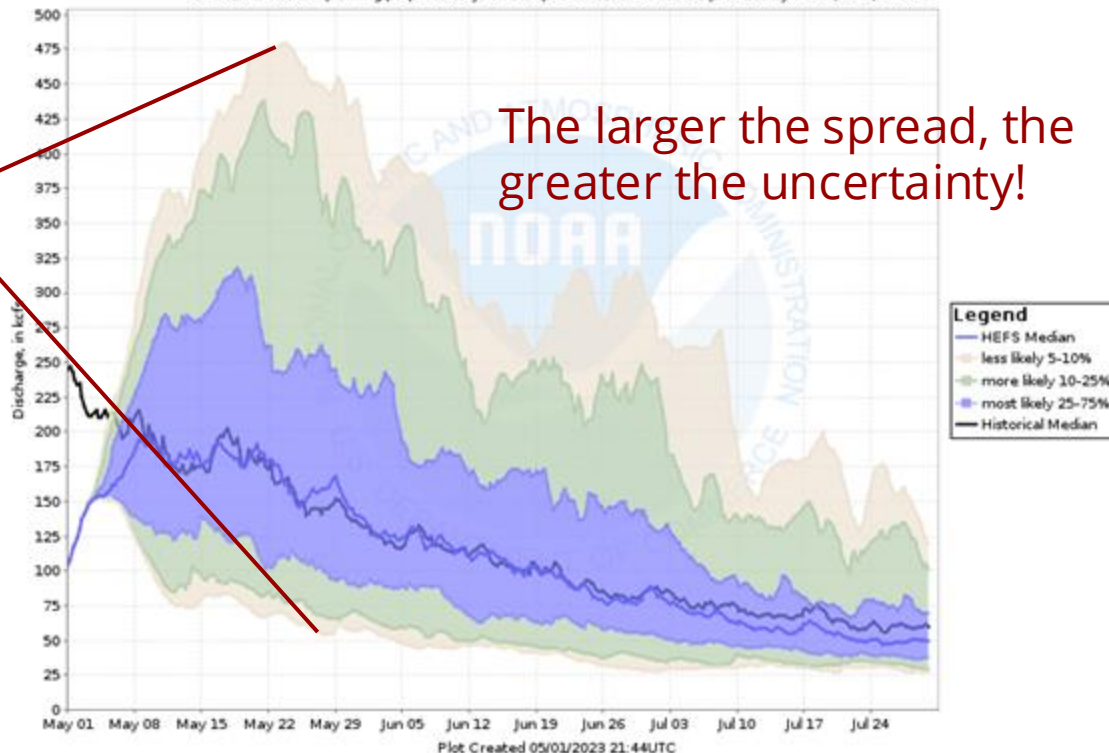


Hydrologic Ensemble Forecast Service



Ohio River at Smithland Lock and Dam, IL (SMLI2)
HEFS Flow Percentiles vs Historical Median
Forecast for the period 05/01/2023 - 07/30/2023

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- Visualize uncertainty and probability

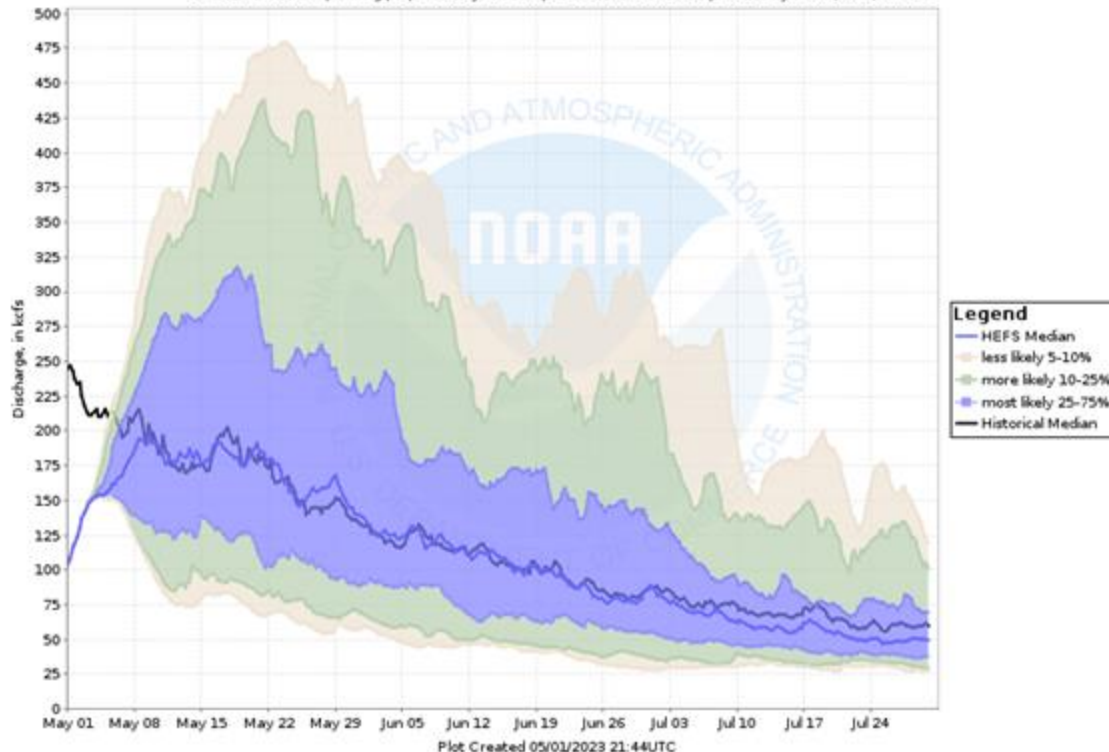
HEFS can take both **meteorological** and **hydrologic** uncertainty into account

Hydrologic Ensemble Forecast Service



Ohio River at Smithland Lock and Dam, IL (SMLI2)
HEFS Flow Percentiles vs Historical Median
Forecast for the period 05/01/2023 - 07/30/2023

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- Look out much further into the future
This example shows 90 days, but can go out much further

2023 Drought - HEFS Example



For the 2nd year in a row - Drought in the Midwest

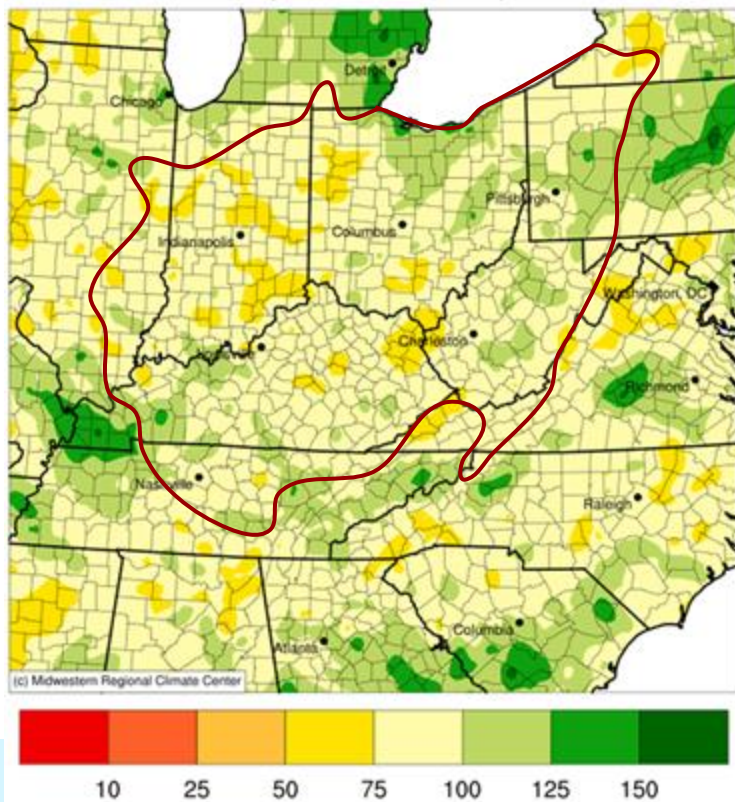
August 25th, 2023 - Midwest Drought Status Update:

- The Ohio River at Cairo, IL dropped almost ten feet since August 16.
- The forecasts and outlooks through early- to mid-September show the persistence of hot and dry weather will likely continue.
- The Ohio River is forecast to have below-normal flows in September, and low stages are expected to persist throughout the length of the Mississippi River. These low flows and stages will likely impact industry and navigation.

2023 Drought - HEFS Example



Accumulated Precipitation (in): Percent of 1991-2020 Normals
June 01, 2023 to October 15, 2023



From 6/1 - 10/15/2023,
percent of normal precip
was quite low

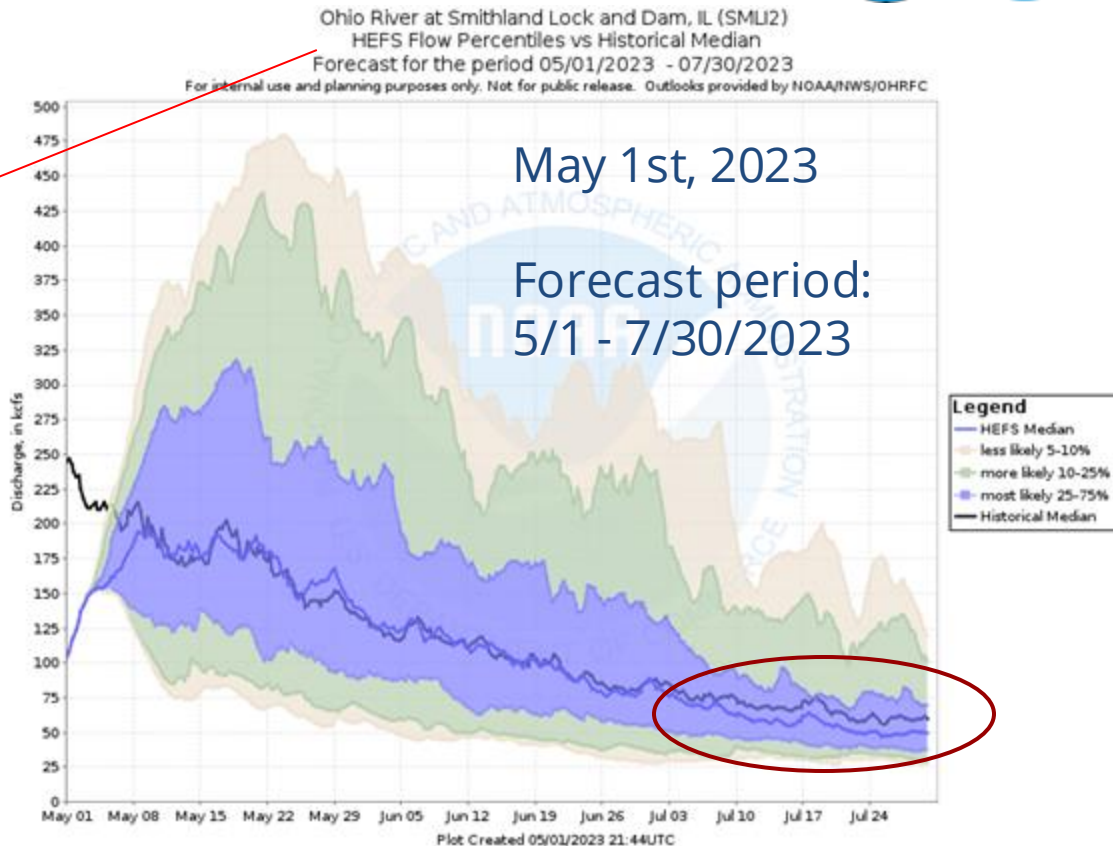
Most areas in the 75-100%
category

Large sections in the 50-
75% category

2023 Drought - HEFS Example



Ohio River at Smithland
- receives most OHRFC
water

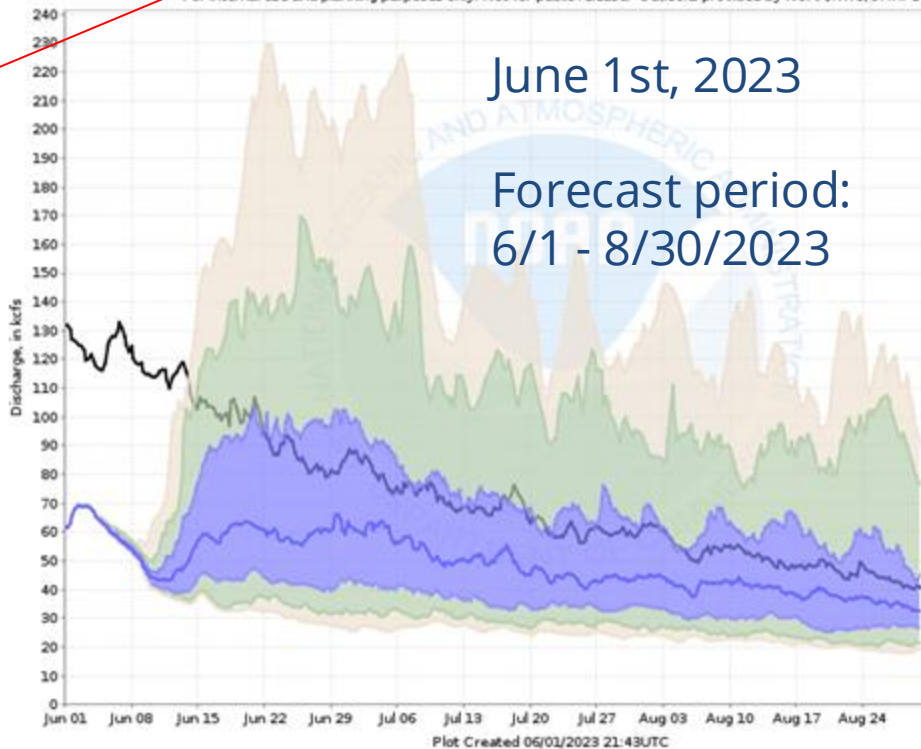


2023 Drought - HEFS Example



Ohio River at Smithland Lock and Dam, IL (SMU12)
HEFS Flow Percentiles vs Historical Median
Forecast for the period 06/01/2023 - 08/30/2023

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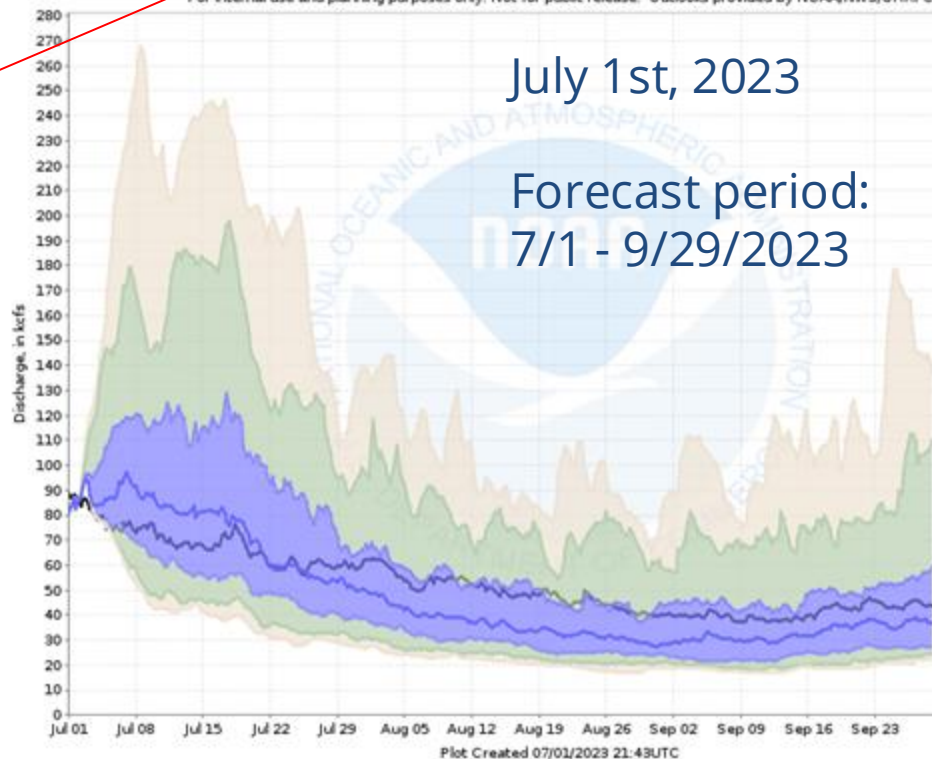


2023 Drought - HEFS Example



Ohio River at Smithland Lock and Dam, IL (SMLI2)
HEFS Flow Percentiles vs Historical Median
Forecast for the period 07/01/2023 - 09/29/2023

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Legend

- HEFS Median
- less likely 5-10%
- more likely 10-25%
- most likely 25-75%
- Historical Median

2023 Drought - HEFS Example



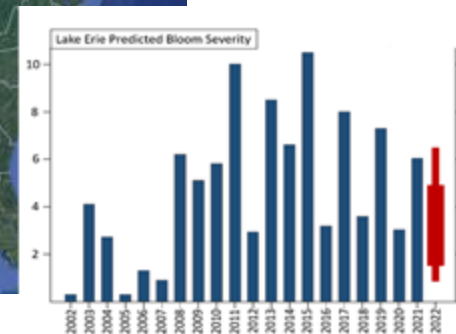
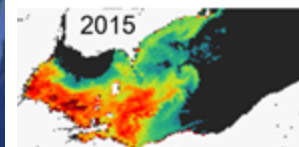
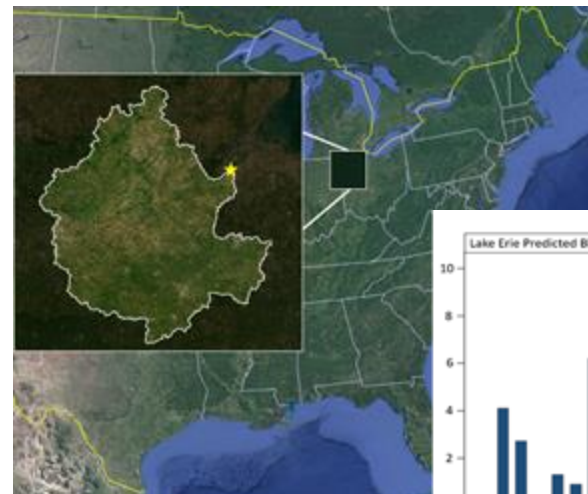
Takeaways:

- Drainage basin outlets show the effects of drought over a large area
- HEFS median for the Ohio River at Smithland was consistently lower than climatological median from late June/early July through the end of the summer
 - Daily predictions were showing this at least as early as April 2023
- This tool gave a pretty good heads-up for OHRFC-wide drought which would go on to occur summer 2023

Who is Using HEFS?



US Army Corps
of Engineers®

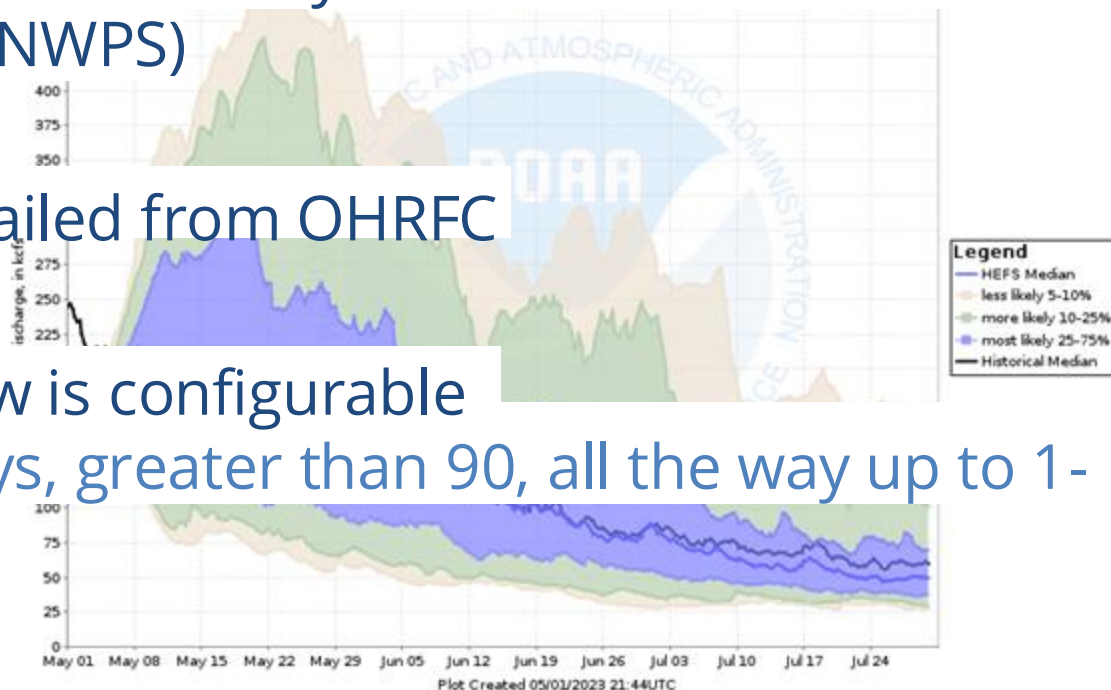


Interested in Using HEFS?



Ohio River at Smithland Lock and Dam, IL (SMLI2)
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Forecast for the period 05/01/2023 - 07/30/2023

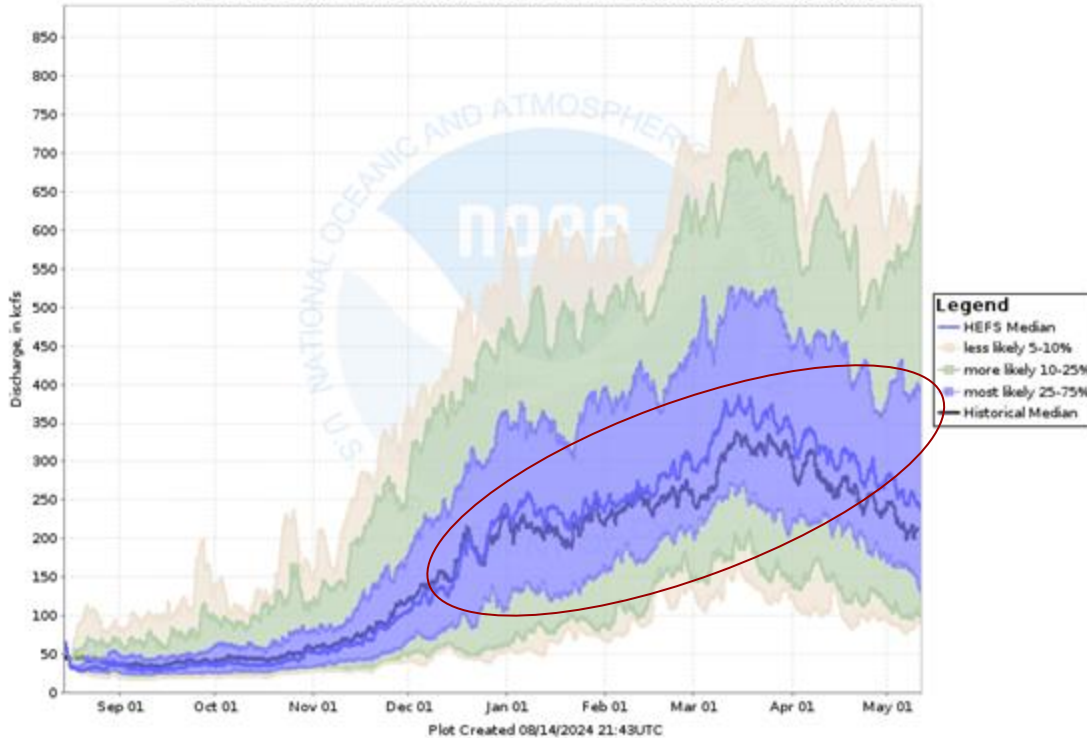
- Long-term HEFS is not currently available on the NWS hydrology website (NWPS)
- Currently being emailed from OHRFC
- The forecast window is configurable
 - Less than 90-days, greater than 90, all the way up to 1-year



270-Day Smithland Flow

Ohio River at Smithland Lock and Dam, IL (SMU2)
HEFS Flow Percentiles vs Historical Median
Forecast for the period 08/14/2024 - 05/11/2025

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Hinting at a pattern shift from drier to wetter

HEFS median separates from Historical Median beginning late fall

Hydrologic Ensemble Forecast Service

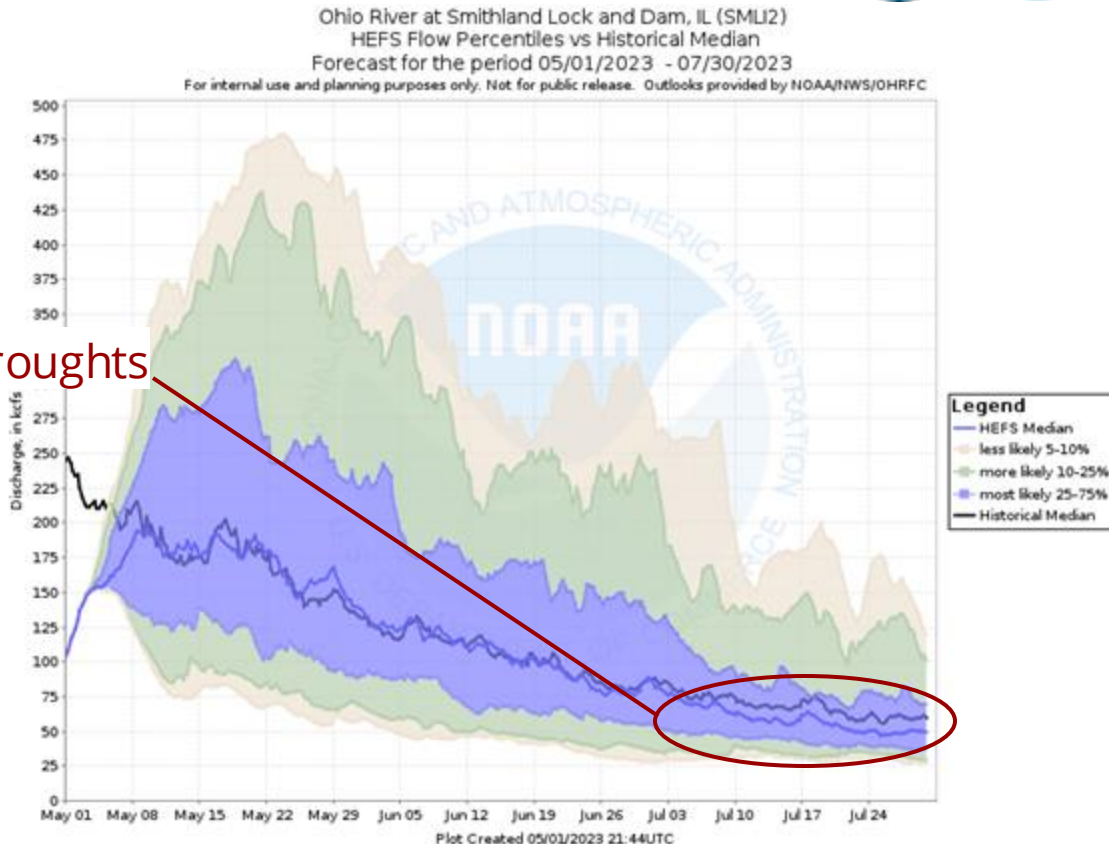


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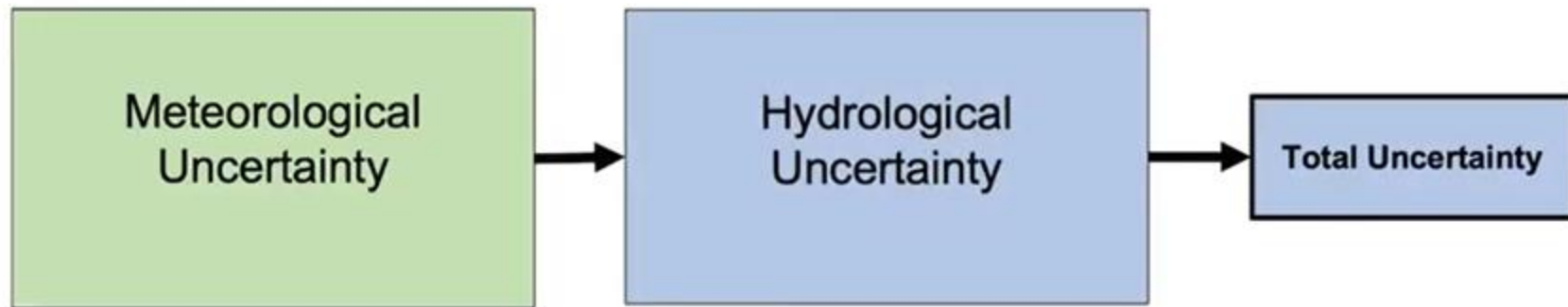
Early indicator for potential droughts

Thanks!

Abram DaSilva
abram.dasilva@noaa.gov



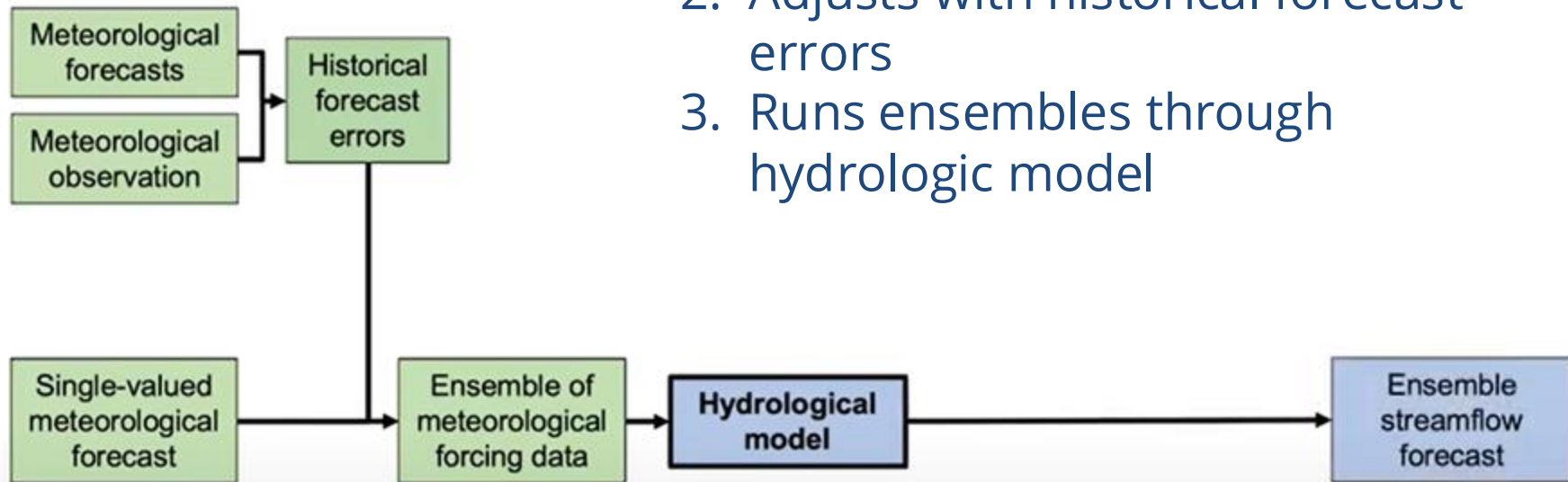
Hydrologic Ensemble Forecast Service



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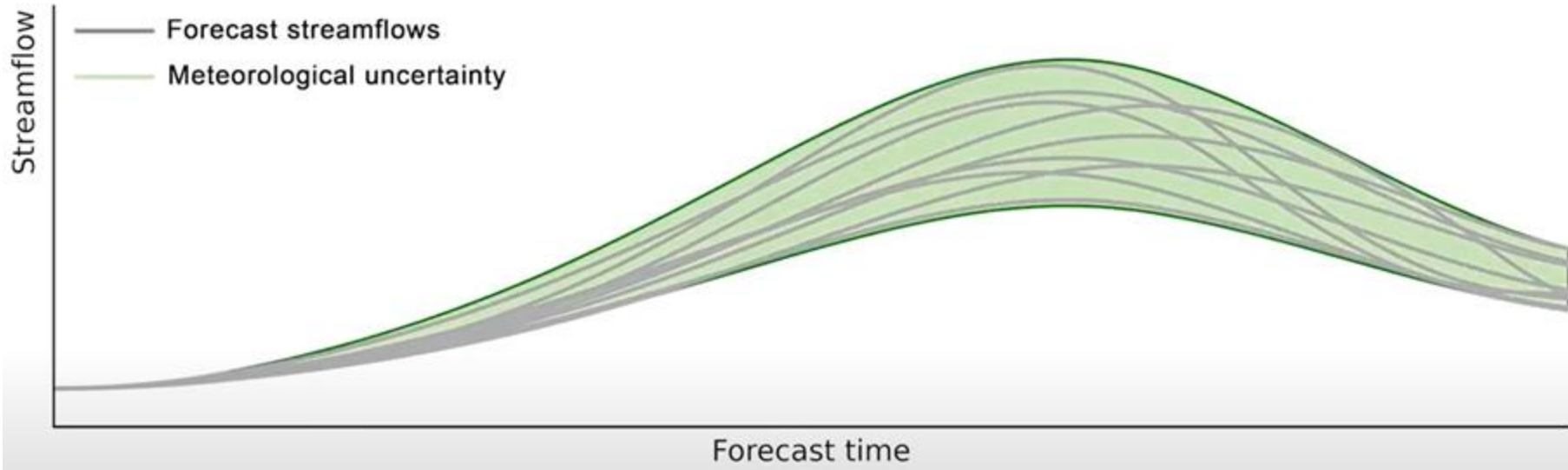


Meteorological Ensemble Forecast Processor (MEFP)



1. Starts with a single-valued forecast
2. Adjusts with historical forecast errors
3. Runs ensembles through hydrologic model

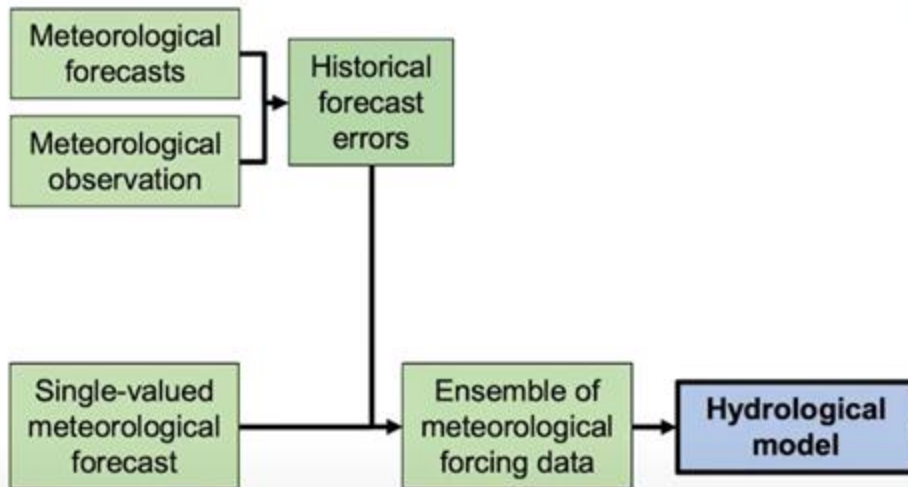
Hydrologic Ensemble Forecast Service



Hydrologic Ensemble Forecast Service



Meteorological Ensemble Forecast Processor (MEFP)



Ensemble Post Processor (EnsPost)

