Hydrologic Ensemble Forecasting Service (HEFS)

Seminar H

HEFS ConOps Discussion

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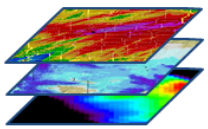
HEFS Components

= Forecast tool (real-time/hindcast)

= Supporting tool

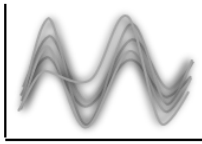
= Future capability



Raw weather and climate forecasts (GEFS, CFSv2,..)

MEFP: pre-processor

MEFP PE: parameters

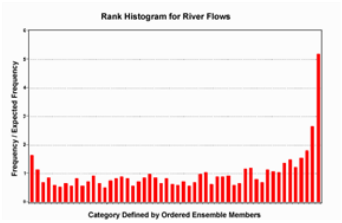


Unbiased forcing (basin scale)

(basin scale)

EVS: verification

Verification results

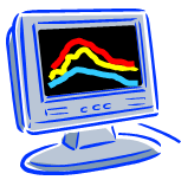


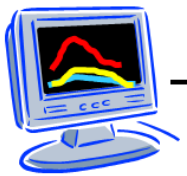
Data assimilator

Hydrologic Ensemble Processor

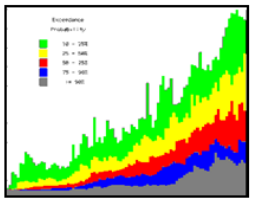
"Raw flow"

"Corrected flow"





GraphGen: products



Ensemble products

Hydrologic data

EnsPost: post - processor

EnsPost PE: parameters

Objective

- **Objective: To get feedback from HEFS RFCs on how to run HEFS in routine CHPS operations**
  - Project planning for the rollout will be discussed during Seminar I – Project Status and Plans
  - Feedback (seminars H and I) will be included in the HEFS ConOps Document, to guide the rollout
  - ConOps has recommendations and options
  - OHD and HEFS test RFCs will iterate on the document through mid-April
  - OHD and all RFCs will finalize the document by the end of May

Outline

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- Implementation
- Operational Runs
- MEFP
- MODs
- Calibration - Parameter Estimation
- Hindcasting and Verification
- Archiving
- New Products
- Training and Out-reach

Implementation

- **On average, how much time has your RFC spent per week on HEFS?**
  - 20 hours per week (last six months)
  - 50% of one person
  - CN & NE 10-20 hours
- **What part of implementation could be improved?**
  - By OHD (training, software, documentation, releases)
  - By you/RFC (more efficient implementation, participation in team)
  - Strategy of incremental rollout?
    - All points or by Forecast group
    - Records of data available
    - Users in mind
    - Hardware issues & configuration management
    - Keep consistent with operational configuration
  - Expectations of hindcasting/verification?
    - Not a crazy idea

Implementation

- **Rank the priorities of HEFS software/science tasks (High, Med, Low)**

Task	Priority
MEFP – fix probability of precipitation bias	
MEFP – evaluating and adjust for extreme events	
MEFP – use grids after 00Z (for 12Z TØ)	
MEFP – running at TØ other than 12Z	
MEFP – canonical events/Schaake Shuffle concerns (FogBugz 979)	
MEFP – add other forcings sources, e.g. WPC QPF	
MEFP – large day-to-day changes to long range forecasts	
Other MEFP issues?	

Implementation

- **Rank the priorities of HEFS software/science tasks (High, Med, Low)**

Task	Priority
EnsPost – run at 6 hr time steps	
EnsPost – evaluate and improve at regulated points	
EnsPost – enhance to use on ephemeral streams	
Add Data Assimilator (account for uncertainty in initial conditions)	
Run-time issues (MEFP, EnsPost, Parameter Estimators, HEFS, EVS, hindcasting, or ensemble runs in general)[1]	
Usability issues (MEFP, EnsPost, Parameter Estimators, HEFS, EVS, hindcasting, ensemble runs in general)	
Others?	

Implementation – Coverage

After two years:

- **ABRFC:** MEFP at 440 basins for precip. & 103 basins for temp.; streamflow at 239 pts; and EnsPost and GraphGen at ~140 of those pts
- **CBRFC:** MEFP at 317 basins & streamflow for ~240 pts and adding EnsPost
- **CNRFC:** MEFP at 319 basins; streamflow at 199 pts.; and EnsPost at 30 pts. Plans to expand EnsPost & add GraphGen
- **MARFC:** MEFP at ~100 basins and streamflow and GraphGen at 53 pts (the Del. R.) for internal use and a second run of MEFP and streamflow for (14) NYCDEP points
- **NERFC:** MEFP at 12 basins; streamflow and EnsPost at 6 pts for internal use and a second run of MEFP and streamflow for (8) NYCDEP points

Operational Runs

- **What are the advantages and recommendations?**
  - Automatic v. interactive
    - What is being done interactively at NE and CN?
      - Manual run (NE & CN)
    - Is it reasonable to do HEFS forecasts interactively (via IFD) one point and step at a time?
  - Configuring workflows – advantages to different scenarios
    - Separate runs for MEFP, precip and temp?
    - Separate runs for different HEFS components?
    - Separate runs for small number of points?
      - Up to each RFC's operational needs

Operational Runs

❑ Timing of runs (in red)

- **Grid downloads**
  - CFSv2: 4x daily {0Z,6Z,12Z,18Z} with 28hr lag to download (12Z/D1 → 16Z/D2)
  - GEFS: 1x daily {0Z} with 8hr lag to download (i.e. 8Z)
- **Grid ingest into CHPS**
  - CFSv2: 1-hour lag from download (5Z, 11Z, 17Z, & 23Z)
  - GEFS: 1-hour lag from download (9Z)
- **MEFP ensemble generation**
  - 1x daily with T0=12Z, but executed at 17:30Z (shifted back); or as early as 9Z, if not using the latest (or any) CFSV2
- **Streamflow ensemble generation**
  - 1x daily with T0=12Z, but executed at 17:30Z
  - Same time as MEFP ensemble generation
  - By Forecast Group (i.e. matches ESP)

Operational Runs

- **Forecast horizon(s)**
  - One long range run for all RFCs needs or separate runs for different forecast horizons?
  - If separate runs
    - Short-medium range: daily
    - Long range: to meet RFC needs, ala ESP runs
    - CN – 14 day (10 mins) and 365 day
    - More runs during flooding

MEFP

- **Forcings – available forecast horizon: recommendation**
  - RFC QPF (0 to X days): recommended if 'large' archive available
  - RFC QTF (0 to X days) – recommended, but believe there's no supportive archive
  - GEFS (0 to 15 days) – recommended
  - CFSV2 (0 to 270 days) – optional; rarely better the climatology; RFCs should validate for their domain
  - Climatology
    - MEFP raw climatology or CHPS raw climatology - recommended (for operational runs)
    - MEFP resampled climatology – not recommended

MODs

- **Manual changes to ensemble traces and means – not recommended**
- **MODs – define modifiersGroup**
  - Okay to use; others not used with ensembles (e.g. CN)

```
<modifiersGroup id="ensembles">
        <modifierId>tschng</modifierId>
        <modifierId>setqmean</modifierId>
        <modifierId>chgblend</modifierId>
        <modifierId>setmsng</modifierId>
        <modifierId>rrichng</modifierId>
        <modifierId>mfc</modifierId>
        <modifierId>uadj</modifierId>
        <modifierId>switchTs</modifierId>
        <modifierId>uhgchg</modifierId>
</modifiersGroup>
```

MODs used in ESP?

MODs may conflict with EnsPost – do some validation

Calibration – Parameter Estimation

- **Calibration - # of years of archive needed[1]**
  - Less than 5 years, is not recommended - problematic for MEFP or EnsPost.
  - At least 10 years is highly recommended
  - 25 years should provide a solid calibration
- **Frequency of calibration - consistency v. operational use**
  - Changes to CHPS configuration
  - Recalibration of or changes to hydro. models
    - Changes to ratings or hydrology
  - New or updated forcings reforecast, e.g. driven by a major updates to models
  - Some changes to HEFS – in release notes; we are trying to minimize these
  - Anticipated frequency ~ 1-2 years; is this reasonable?

Hindcasting and Verification

- **Recommend hindcasting/verification at RFCs in partnership with OHD**
  - Provide objective guidance for better implementation
  - Validate HEFS as the source of public products, such as AHPS - OHD/RFCs need to develop criteria and plans
  - Practical tips - already provided & in hindcasting guide

Archiving

- **What to archive – recommended at RFCs**
  - Latest 30 days of CFSV2 and GEFS grids (move to NWC?)
  - RFC QPF (already archived?)
  - MEFP temperature and precip ensembles
  - Streamflow ensembles based on MEFP with climatological forcing (if produced)
  - Streamflow ensembles based on your operational ESP
  - Streamflow ensembles without and with (if produced) EnsPost applied
- **Format – recommended (smallest output) for EVS**
  - .fi/.bin – fastinfoset / binary

(Public) Products

- New product: 10-day streamflow forecast with uncertainty bounds (testing at ABRFC)
- Provide streamflow forecasts as data (time series) ? If so, to what forecast horizon(s)?
- Others?
- Any new products should have a baseline GG template – agreed? -
  - Yes

Training and Out-reach

- **At your office, besides HEFS focal points, who (other RFC staff, WFOs, stakeholders (e.g. emergency managers) need training on:**
  - HEFS functionality and mechanics (using/implementing HEFS)?
  - Hydro. ensembles and probabilities (understanding HEFS forecasts)?
- **Assuming they need training, how / who does the training? RFCs, OHD, on-line training/documents?**
  - RFC Staff – DOH and HEFS Focal Point?
  - WFOs
  - Stakeholders (emergency managers)
  - Others

Training needs (beyond HEFS focal points)

Group	HEFS use/impl.	Trainer	Hydro. Ens/Prob	Trainer
Other RFC staff			Everyone	HEFS Focal point
WFOs			Yes	RFC/OHD?
Stakeholders				

Questions and comments?