



Science Infusion, RTO Transition & Phase-2 Planning

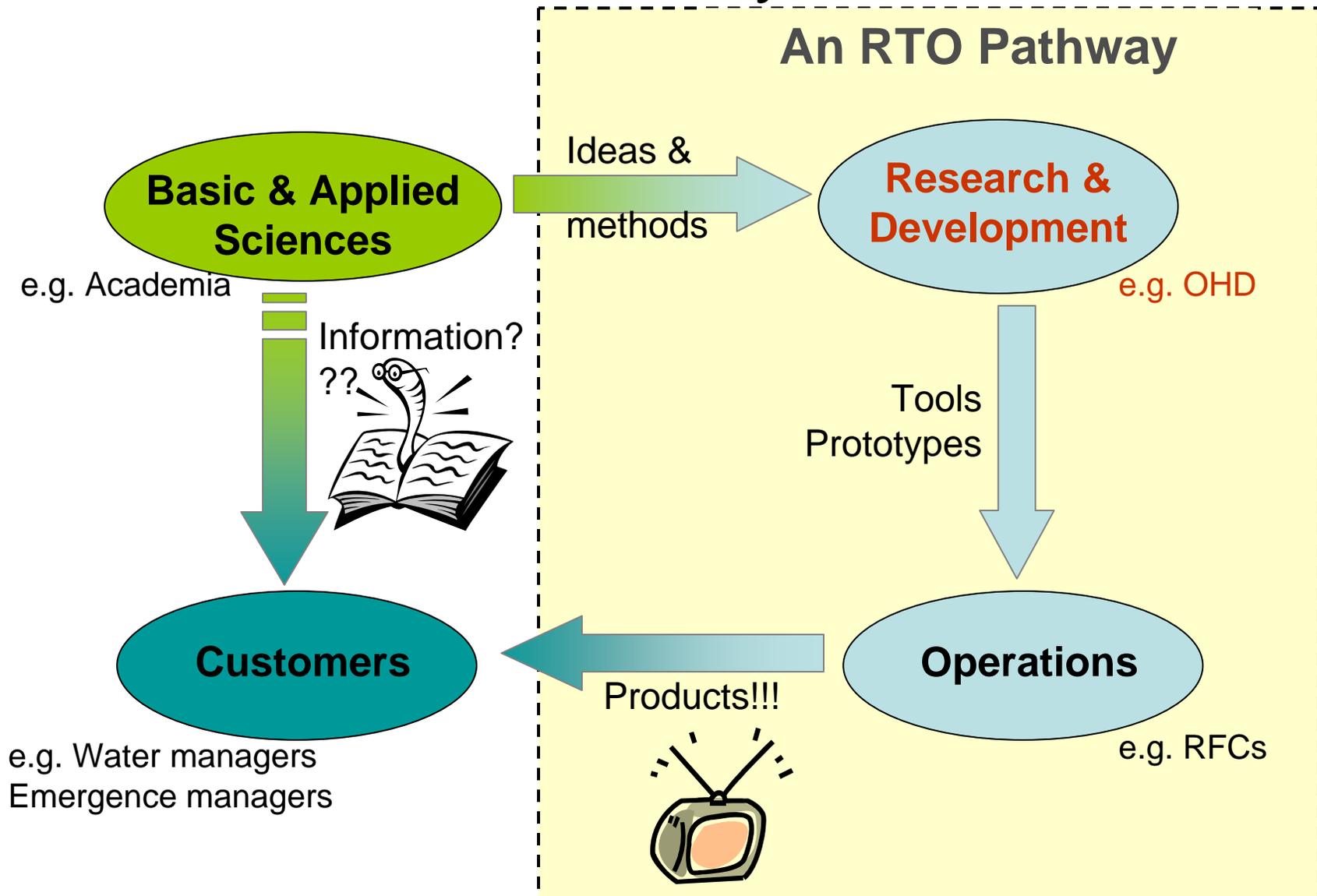
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Science Infusion & Research-to-Operations Transition

From Science To Products & Services: Pathways?

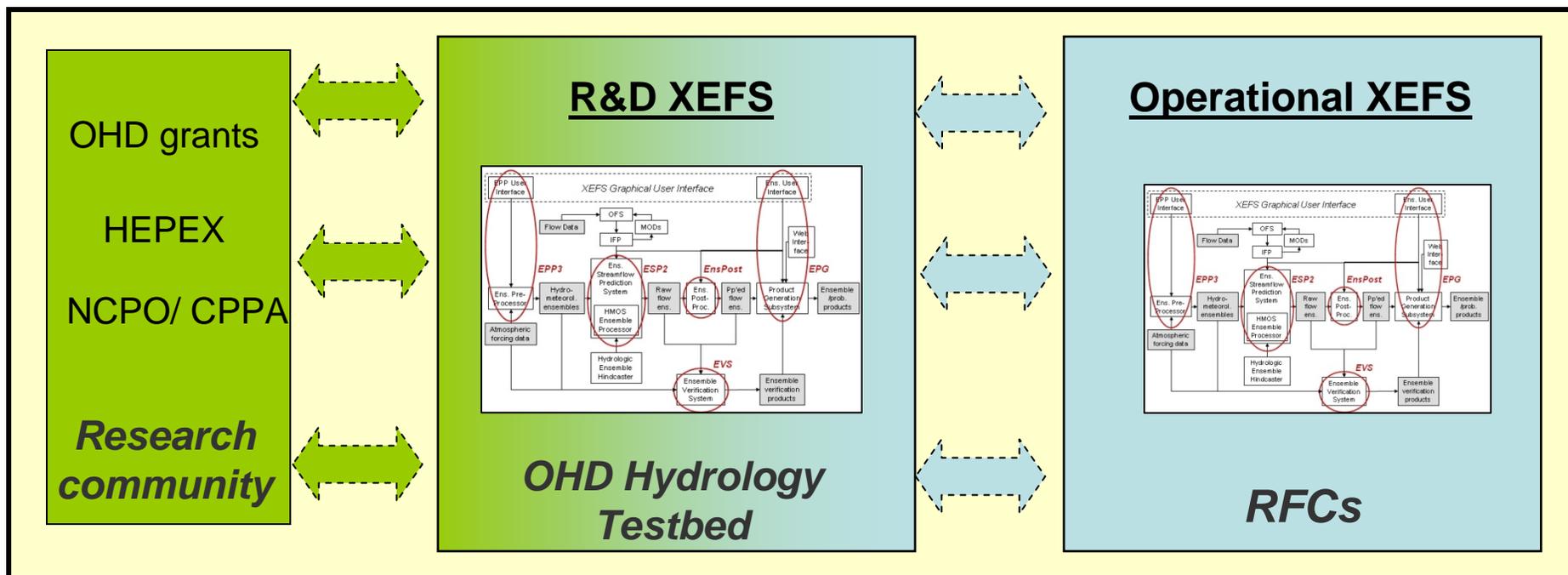


R&D XEFS:

Facilitating SI and RTO in Hydrologic Ensemble Forecasting

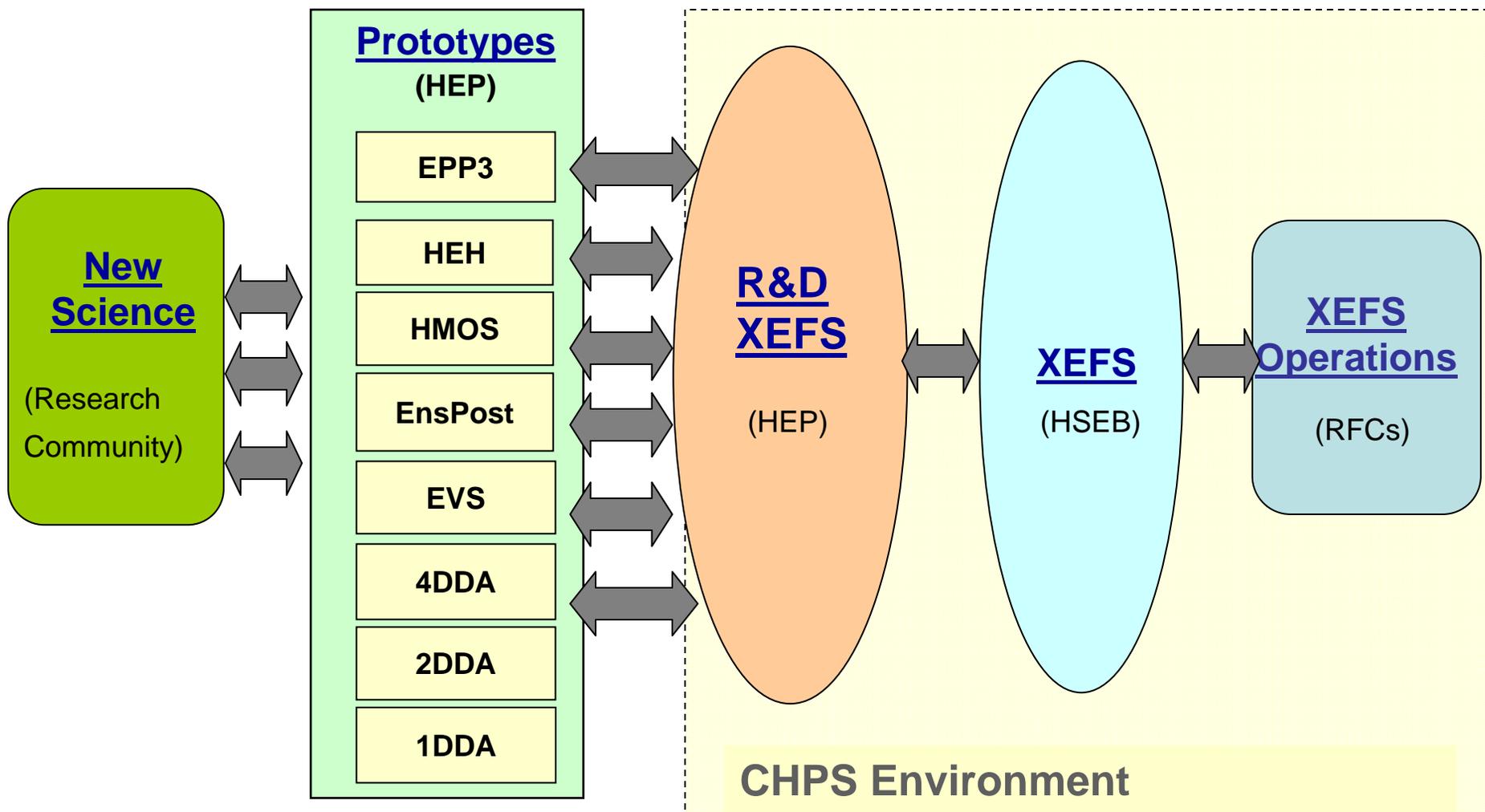
Overarching Goal: To expedite science infusion and research-to-operations transition in hydrologic ensemble forecasting

- ✓ Provides flexible R&D environment that is functionally equivalent to operational XEFS to develop, test and evaluate new science capabilities
- ✓ Enables in operational XEFS plug-and-play of new capabilities





RTO Framework Being Developed



Streamlined and coordinated

Targeted Functionalities of R&D XEFS

Components

- ✓ Ensemble pre-processors
- ✓ Hydrologic ensemble processor
- ✓ Hydrologic model-output statistics
- ✓ Ensemble post-processors
- ✓ Ensemble hindcaster
- ✓ Ensemble verification
- ✓ Data assimilators
- ✓ Interfaces

Functionalities

- ✓ Ensembles
- ✓ Calibration
- ✓ Forecasting
- ✓ Hindcasting
- ✓ Data assimilation
- ✓ MODs
- ✓ Verification
- ✓ Visualization
- ✓ FEWS capabilities
- ✓ CHPS compatibility
- ✓ AWIPS II compatibility?





R&D XEFS Development: Status & Plans

- **Approach/Plans**

- Leveraging FEWS, CHPS
 - To enable R&D environment that is functionally equivalent to operational XEFS
- **Phase I:** linking prototypes together with FEWS to form an integrated system
 - Leverage HSEB efforts in FEWS model adaptor development
 - Construct user-specific workflows
- **Phase II:** enabling additional ensemble forecasting capabilities, including ensemble data assimilation
 - Implement, test and evaluate planned enhancements
 - Integrate data assimilators

- **Current Status**

- Testing FEWS for large-sample hindcasting
 - Capabilities in ensemble forecasting & hindcasting, calibration and DA across different time and spatial scales
 - Flexibility for infusing new science advances





XEFS Phase-2 Planning



Potential Phase 2 capabilities

- **EPP3**

- Use of diurnal cycle-resolving (e.g. hourly) temperature forecast.
- Incorporation of the NCEP climate outlook forecast.
- Comparative assessment of skill in CFS and climate outlook forecasts.
- Objective/optimal merging and joining/blending of short-, medium- and long-range ensembles.
- Use of PE forecast for generation of PE ensembles.

- **ESP2**

- ensemble data assimilation (DA) to reduce uncertainty in the initial conditions and to keep track of growth (due to accumulation of errors in time and/or through the forecast system) and reduction (due to newly available observations) of uncertainty,
- the parametric uncertainty processor to reduce and to explicitly account for uncertainty associated with model calibration,
- multimodel ensemble to reduce the effects of and to account for structural errors in our models, and
- new techniques for modeling of flow regulations and accounting of uncertainties associated with them.

- **EVS**

- Develop easy-to-understand verification statistics for operational hydrology that can be easily and clearly communicated to the customers and users.
- Compute confidence intervals for verification statistics.

http://www.weather.gov/oh/rfcdev/docs/XEFS_design_gap_analysis_report_final.pdf



Objectives of this activity

- Develop the XEFS Phase 2 R&D and RTO plan
- Identify ensemble and data assimilation (DA) capabilities that may address new and existing service needs (particularly in light of recent experiences and emerging issues: see next slide)
 - Implementable in CHPS
 - Steer enhancement/evolution of FEWS
 - Strategically strengthen the hydrology program within NOAA and collaborations with the external research community



Recent experiences, emerging issues

- Floods of 2008 (NC-, MBRFCs)
- Floods of 2007 (WG-, ABRFCs)
- Hurricanes Katrina, others (LMRFC, others)
- Drought (western RFCs, SERFC)
- Climate change
- Others (to be identified)

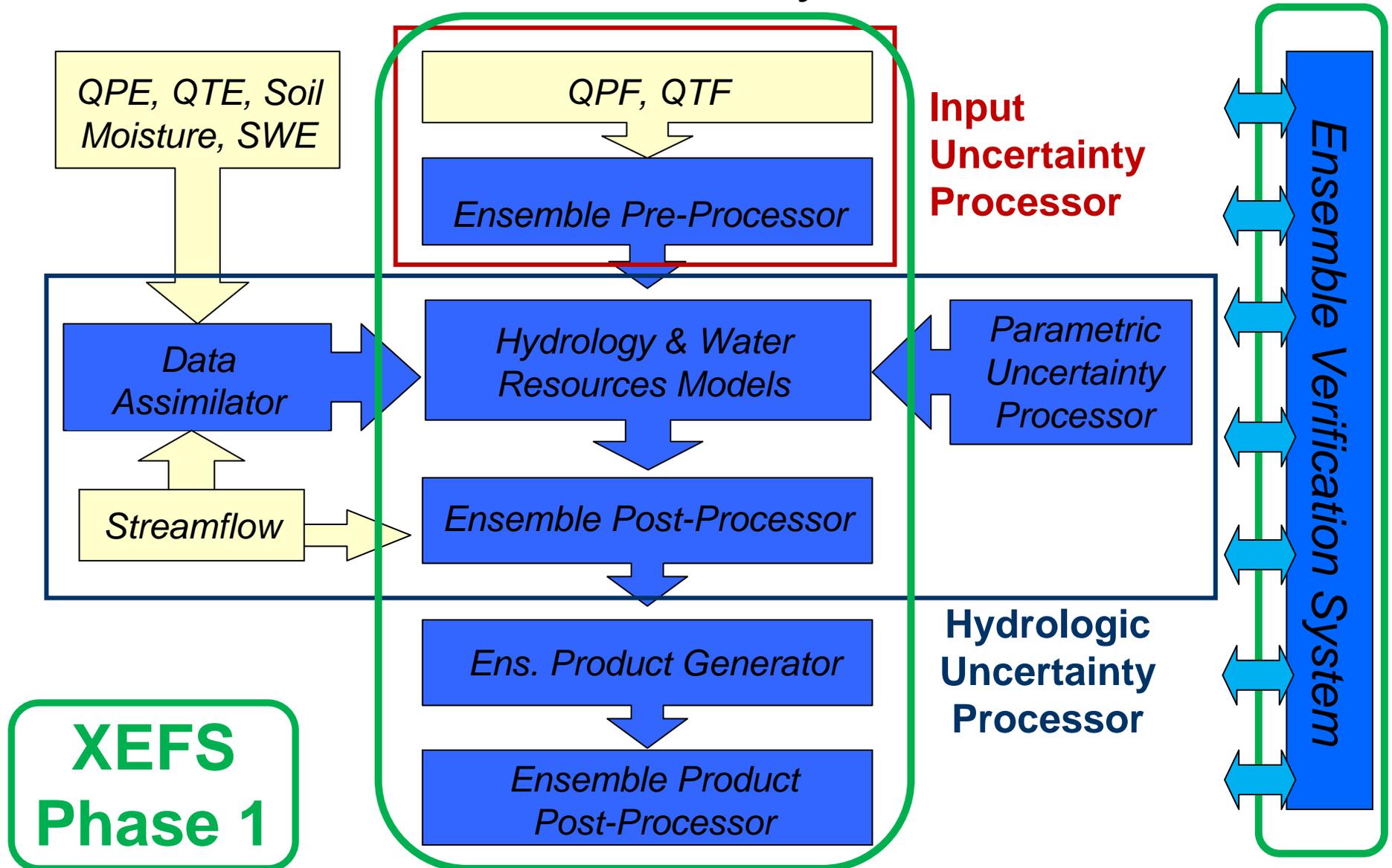


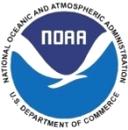
Data assimilation (DA)

- Targeted for XEFS Phase 2 and CHPS
- Just what do we mean by “data assimilation”?
 - High-quality analysis is a requisite for high-quality forecasting
 - High-quality calibration/parameter estimation is a requisite for high-quality simulation
- Why should we care?
- What is OHD doing?

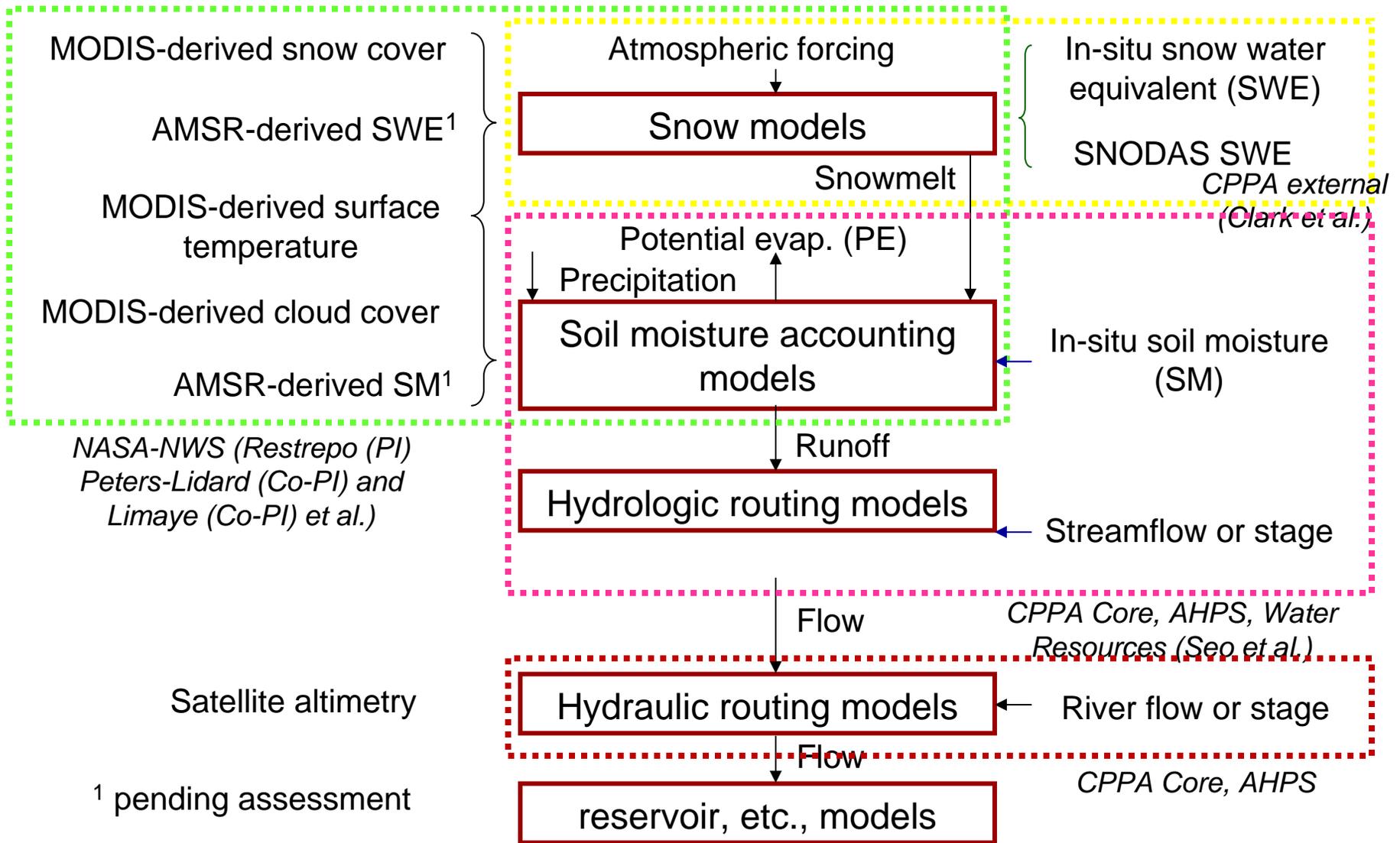


Elements of a Hydrologic Ensemble Prediction System





Operational hydrologic Data Assimilation - Strategy



Adapted from OHD Strategic Science Plan 2008



Proposed agenda

- 1-hr conf calls on Jul 23, Jul 30, Aug 6, Aug 13, Aug 20, Aug 27 (and possibly more in Sep)
 - Each RFC makes a 15 min presentation for its service needs/vision that XEFS (including DA) may help address (~3 calls)
 - HEP (Yuqiong, DJ) synthesize the input, and identify potential science solutions and gaps for the needs/vision
 - RFCs and HEP discuss/brainstorm (~3 calls); Yuqiong and DJ will capture the content into a rough plan
 - RFCs and OHD review and revise the plan. (probably via email, but conf-call if necessary)
 - The goal is to complete the activity by the end of Sep



End of slides