



World Meteorological Organization

Working together in weather, climate and water

Reporting on Task Team on Interoperable Technologies to Advance Flood Forecasting

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Definition

Interoperability: the ability of modelling systems or software to automatically exchange and make use of information from one to another. In the context of the flood forecasting domain, this can also mean interoperability between models made by different individuals or groups, such that they can easily interface with **a *platform***

Platform: software able to provide interoperability of modelling systems that do not possess this capability. It may also allow input of data with different formats and may provide output in a multiple of ways (graphs, tables).



Definition

Interoperable Technology promoted by this CHy initiative *must* be operationally used, be freely available, have low hardware requirements, be available in one of the official UN languages, have available training material, be sustainable (longevity aspect) and be institutionally supported. Such technology also *should* be open source and be easy to use (simplicity).



Criteria for assessment

Develop initial list of review assessment criteria

- **Must**: Strongly to be required
- **Should**: Important components
- **Could**: Less important but good to have

Develop initial draft short-list of existing hydrologic models and platforms

- ✓ Models: HEC-HMS, HYPE, URBS, HBV aka HBV96, GRM
 - ✓ Platforms: HEC-RTS, AEGIR + HYFO, Delft FEWS, K-EWS
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Criteria for assessment

Criteria	Model (HEC-HMS)	Platform (HEC-RTS) designed for HEC software
Operationally used(must) model and platform	Y	Y (internally and possibly a few external)
Freely available	Y	Y
Hardware requirements (low end)	Y	Y (windows server, 8-12 cores)
Availability of training material	Y	Under development
Institutional Support	Y	Y
Languages training and software	Y - English	Y - English
Sustainability - longevity	Y	Y (new initiative, uncertain future)
Peer review or Case studies (modelling only)	Y	
Open source or source is available (should) model and platform	N	N
Updating (modelling only)	Y	
Simplicity – calibration, parsimony (modelling only)	Y	
Simplicity – usability(m & p)	Y	N (Powerful & flexible)
Pre-existing CoP (m &p) could	N	N

Criteria	Model (HEC-HMS)	Platform (HEC-RTS) designed for HEC software
Data Format (model) could	N – Uses ACE formats???	
Data Format (platform) must/should		Y, possibly one WMO format, Y API used
Visualization (platform)		Y
Data QA/QC (platform)		Y
Open/closed platforms		Y (open)(but complex to do)
Internet-based system (platforms)		N
Redundancy capability (platforms)		Y

• **Criteria for “data format” for models:** To promote interoperability, the hydrological, hydraulic or reservoir model’s data structure (input/output) *should* be documented with the programming Application Programming Interface (API) being made freely available

• **Criteria for “data format” for platforms:** To promote interoperability, the platform *must* allow multiple input formats (documented), *should* support at least one WMO format, and *should* document its output format with the programming Application Programming Interface (API) being made freely available.

• **Open versus closed systems:** open systems can easily incorporate a variety of hydrological, hydraulic and reservoir models, while closed systems are built for specific models and cannot easily add other models without undertaking complex coding



Hydrologic Model Template

Short Name	. HBV
Long Name	. Hydrologiska Byråns Vattenbalansavdelning model
Model Type	. Continuous, semi-distributed model
Usage	<ul style="list-style-type: none">. Riverine Flood Forecasting and Flow(low to high) Forecasting. Simulation of hydrological time-series. Short range forecast, Inflow volume forecast,. Simulations in ungauged catchments. Climate change studies
Background	<ul style="list-style-type: none">. A computer simulation used to analyze river discharge and water pollution. To create a conceptual hydrological model with reasonable demands on computer facilities and calibration data. The model is a standard forecasting tool in Sweden and other Nordic countries, and also used for simulations in ungauged catchments, mainly in small and unregulated rivers. Developed by SMHI in the early 70's to assist.. In 1993 the Swedish Association of River Regulation Enterprises (VASO) and the SMHI initiated a major revision of the structure of the HBV model. HBV-96 is the final result of this model revision



Hydrologic Model Template

Developer	. SMHI
Channel Routing	. Muskingum or Nonlinear storage function for channel routing ?
Reservoir Operation	
Number of Calibration Parameters	
Institutional and operational effort	
Snow Accumulation	. calculated after defining a threshold melting temperature . the result is divided into a liquid part that is the surface runoff and a second part that infiltrates
Precipitation	. Sub-basin average
Evapotranspiration	. input to the model
Calibration/Optimization	
Updating/Assimilation	
Snow Accumulation	. calculated after defining a threshold melting temperature . the result is divided into a liquid part that is the surface runoff and a second part that infiltrates



Hydrologic Model Template

Precipitation	. Sub-basin average
Evapotranspiration	. input to the model
Calibration/Optimization	
Updating/Assimilation	
Input Data	. Daily Temperature, Rainfall, Monthly Potential Evapotranspiration
Model Output	. Daily Discharge
Hardware requirements	. PC
Operating System	. Windows
Programming Language	. Fortran
Open Source	. Yes
Download URL	
Language of Software	. Swedish and English
Training Material URL	
Guidance Material URL (including case studies)	



Hydrologic Model Template

Latest Update & Version	.1996?
References	.Bergstrom, S. (1995) The HBV Model. In V.P. Singh (Ed.) Computer models of watershed hydrology, pp. 443-476, Water Resources Publications, Highland Ranch, Colorado, USA.
Contact Organization	. https://www.smhi.se/en/services/professional-services/energy/hbv-state-of-the-art-hydrological-modelling-1.7540
Model Schematic	

Table update 14 Nov 2017



Additional Models & Platforms

must pass screening criteria

Hydrologic Models

- Lisflood
- Sacramento
- WFlowDeltares
- X
- X
- X

Platforms

- Green Kenue
- La POM
- JRCEFAS platform?
- Y
- Y
- Y



Additional Models & Platforms

must pass screening criteria

Hydraulic Models

- Lisflood
- Telemac 1- and 2-D
- MASCARET (Schapi, France)
- ISIS (EA, UK)
- SOBEK (Deltares)
- Delft 3D-FM
- X
- X

Reservoir Management/Operations

- HEC-ResSim
- HYPE reservoirs module built-in
- Y
- Y
- Y



Further Consideration

- **Costal Flooding(river-ocean modelling and forecasting)**
 - **Real time or Pre-processed Flood Maps for impacted communities**
 - **Flood Risk Modelling**
 - **Flash Flood Forecasting, etc**
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Future Plan

Action	Name	Deadline
Platforms draft Template	Jeff	Jan 2018
Hydraulic Model draft Template	Jeff	Jan 2018
Reservoir Operation Model draft Template	Bill with Yeshewa	Jan 2018
Guidance material of NWP formulation for Flood Forecasting	Narendra?	?
Guidance material or Model of CIFDP (the Coastal Inundation Forecasting Demonstration Project)	Yuri	? 2018
Request for reviewing and populating our works & collecting case studies to Regional Hydrology Advisors, NMHSs, OPACHE, AWG of CHy	Rin	Mar 2018

Teleconference : 16 Feb 2018 Geneva 12:00 P.M for 90 min

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU



WMO OMM

World Meteorological Organization
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Thank you
Merci

