World Meteorological Organization

Working together in weather, climate and water

WMO

WMO Flood Forecasting Initiative and End-to-End Early Warning Systems for flood forecasting

Y. Simonov

Hydrological Forecasting and Water Resources Activities

- WMO Flood Forecasting Initiative
  - Advisory Group
  - Global Flash Flood Guidance System
  - Coastal Inundation Forecasting Demonstration Project
  - Severe Weather Forecasting Demonstration Project
- Implementation Strategy for the End-to-End Early Warning Systems (E2E EWS) for flood forecasting (using the Community of Practice approach)

FFI

FFI Objective

Improve the capacity of meteorological and hydrological services *to jointly deliver timely and more accurate products and services required in flood forecasting and warning* and in collaborating with disaster managers, active in flood emergency preparedness and response.

Expected results

a) Improved quantitative and qualitative weather forecasting products are available in such a way that these can be directly used for flood forecasting;

b) Medium-range weather forecasting and climate prediction tools can be applied to extend warning times and produce pre-warning information;

c) NMHSs have improved their capacity to cooperate to jointly deliver timely and accurate flood forecasting information;

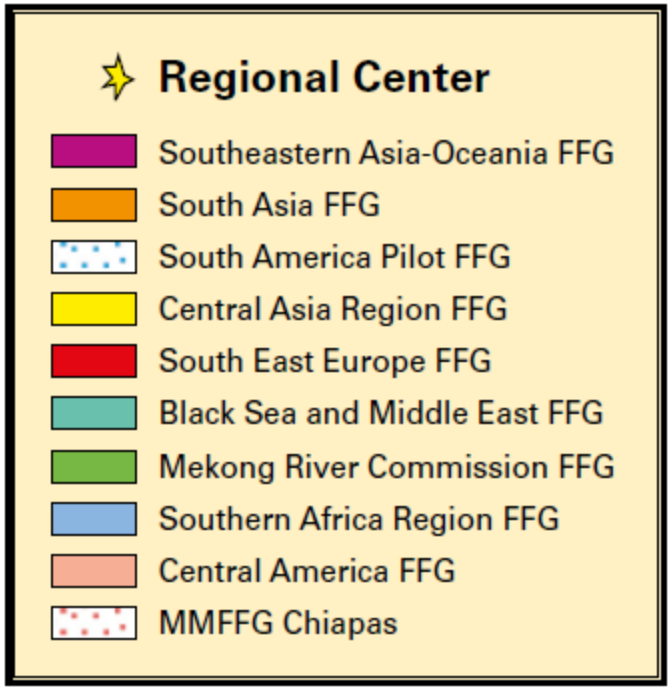
d) Integrated weather, climate and hydrological forecasting information are available in a relevant format for use by civil organizations responsible for disaster preparedness and mitigation.

FFI – Advisory Group

World Meteorological Congress XVI (Cg-16) passed in 2011 **Resolution 15** (Res. 15 Cg-16) establishing the **WMO Flood Forecasting Initiative – Advisory Group (FFI-AG)** with the objective to:

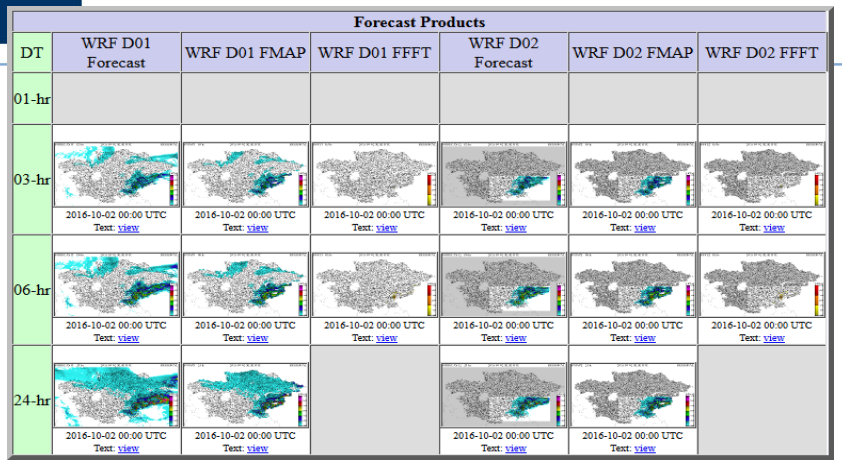
- **provide guidance and advice on the hydrological forecasting** elements of a number of flood-related initiatives and programmes in progress under WMO programmes
- **provide broad-based support to improve collaboration between the meteorological and hydrological communities** for improved flood forecasting related practices.

Flash Flood Guidance System

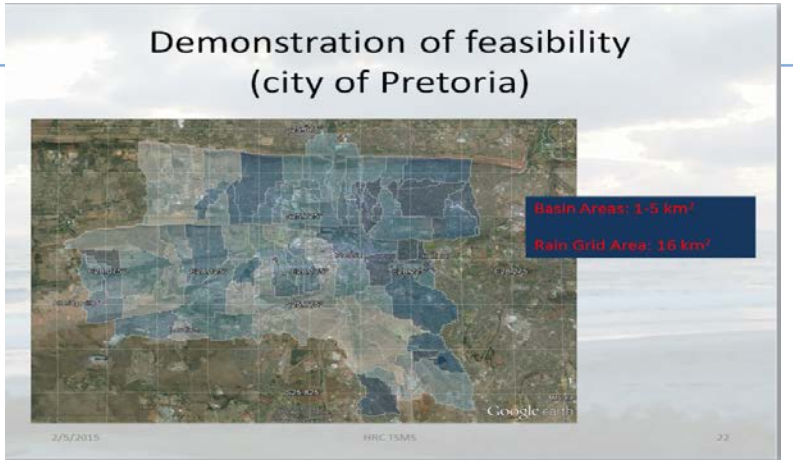


The Flash Flood Guidance System with global coverage consists of eight regional FFGSs in different stages of development and operational use. Four systems are operational, initial versions were implemented for four, and one is under development

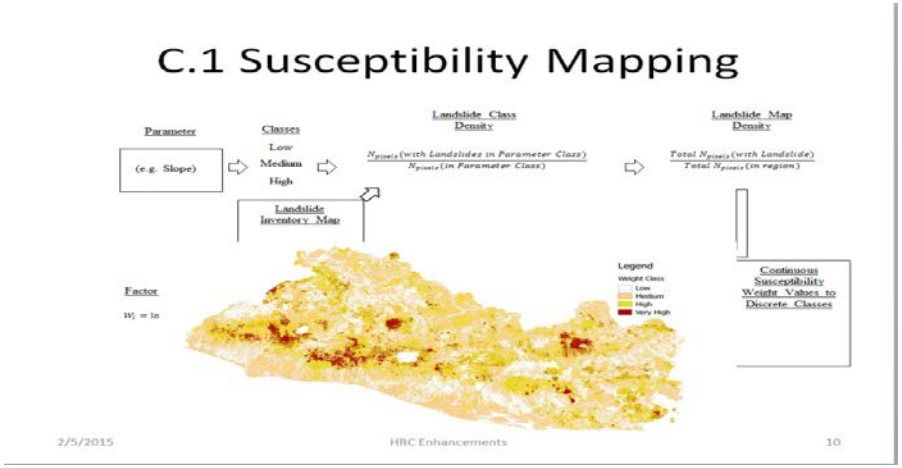
FFGS Advances



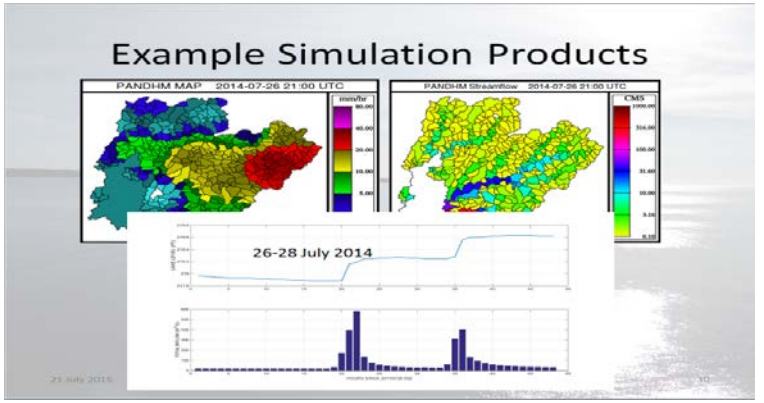
- Multi-NWP Model ingestion



- Urban Flash Flood Early Warning System

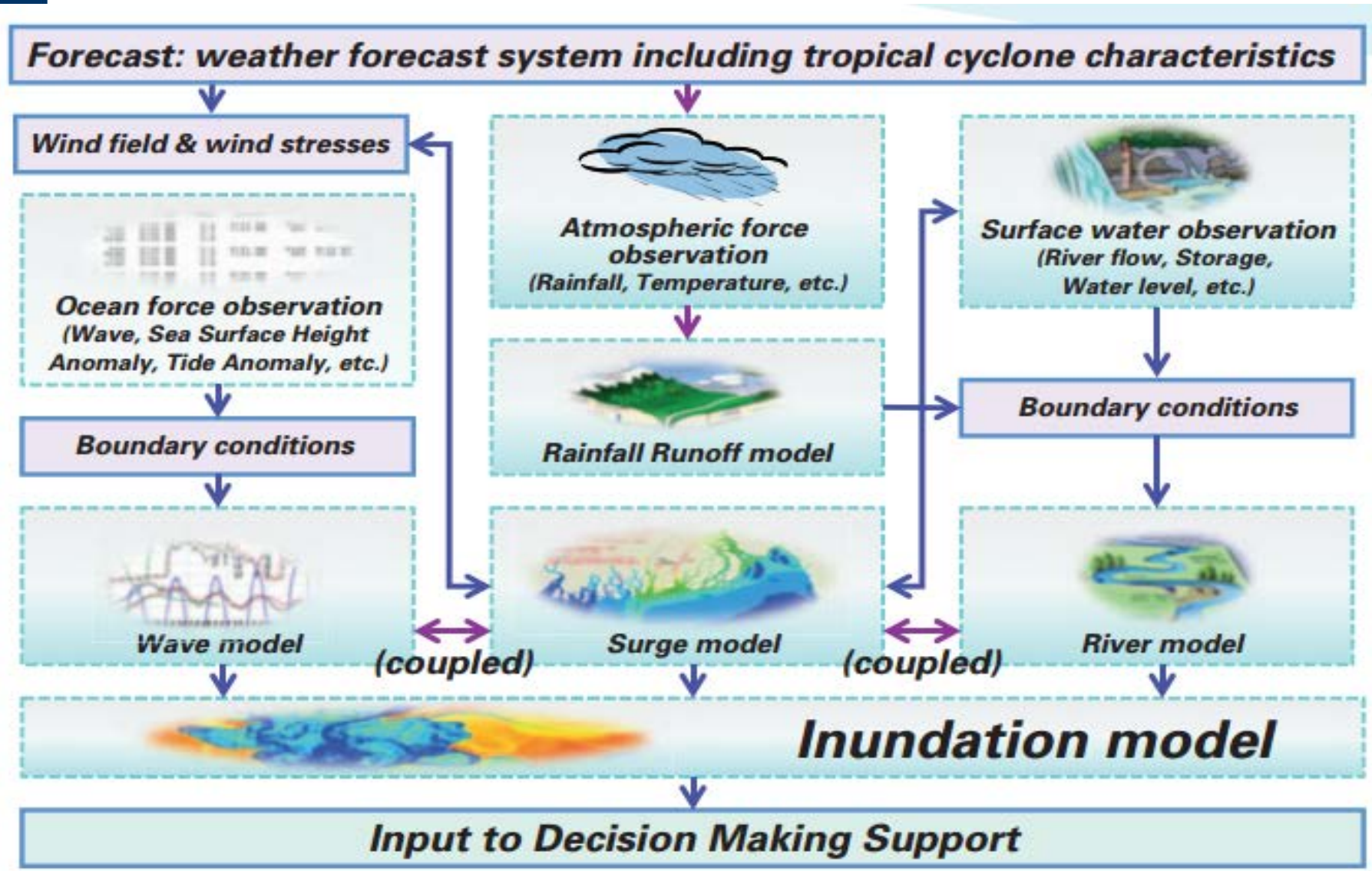


- Landslide Susceptibility Mapping



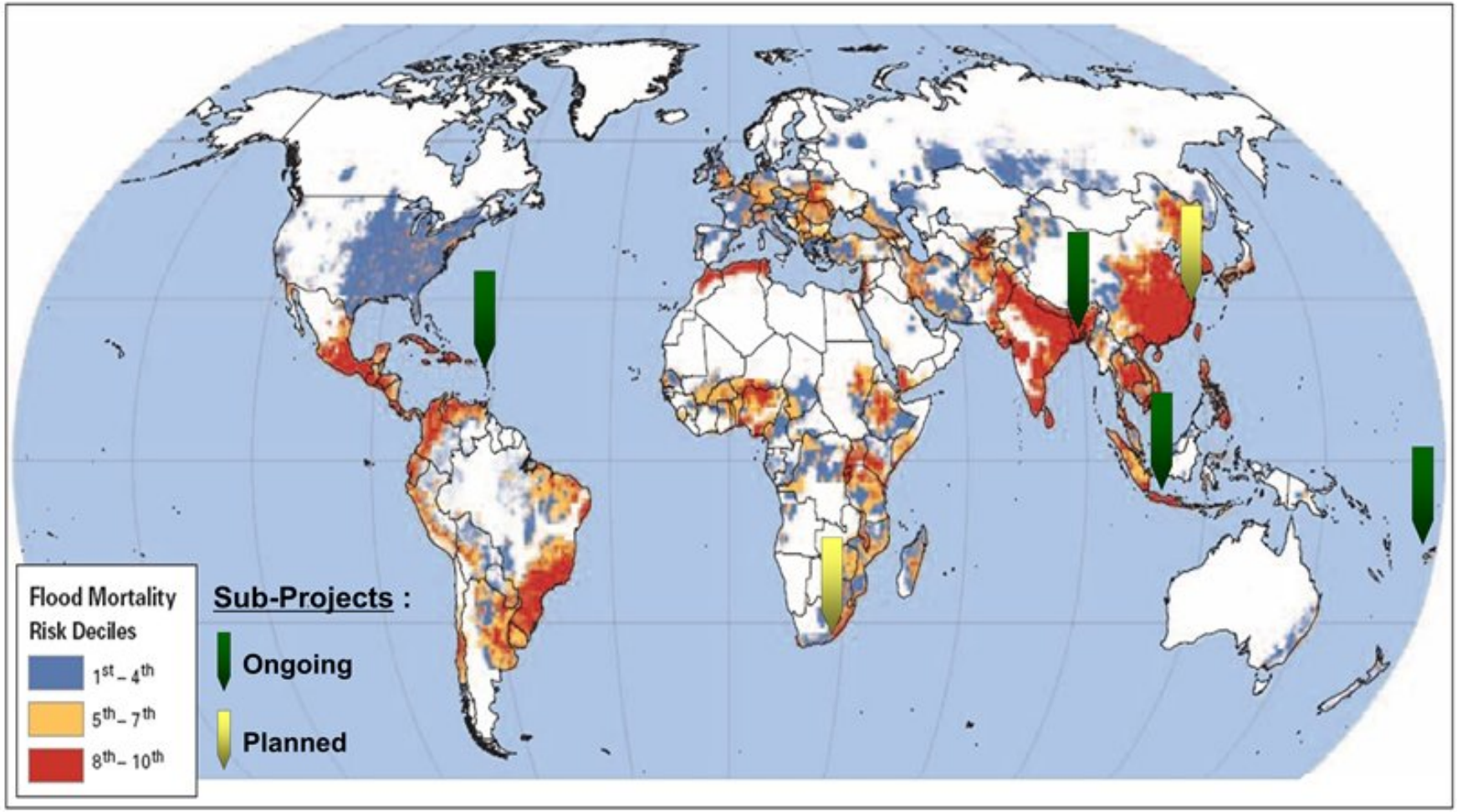
- Expandable and Scalable Riverine Routing (Riverine Forecasting)

CIFDP Modelling Framework



http://www.jcomm.info/CIFDP

CIFDP Implementation



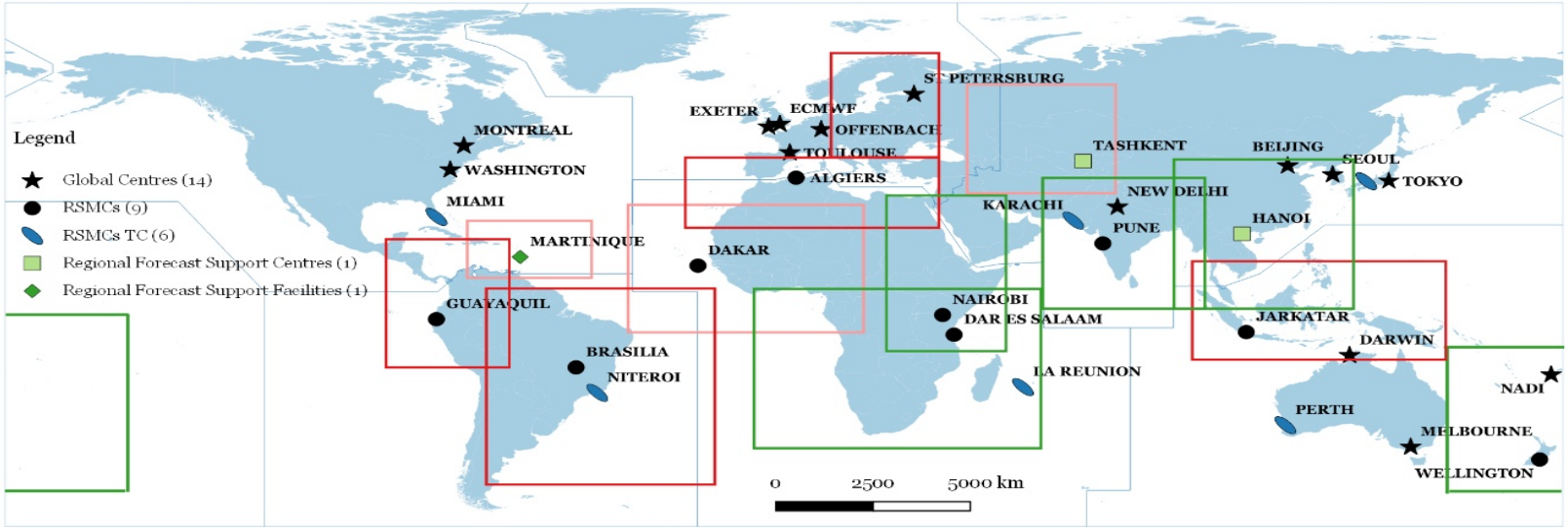
http://www.jcomm.info/CIFDP

Severe Weather Forecast Demonstration Project

WMO's Severe Weather Forecasting Demonstration Project (SWFDP)

Strengthening capacity of NMHSs in improving forecasts and warnings of meteorological hazards since 2006

Updated on 29 August, 2018



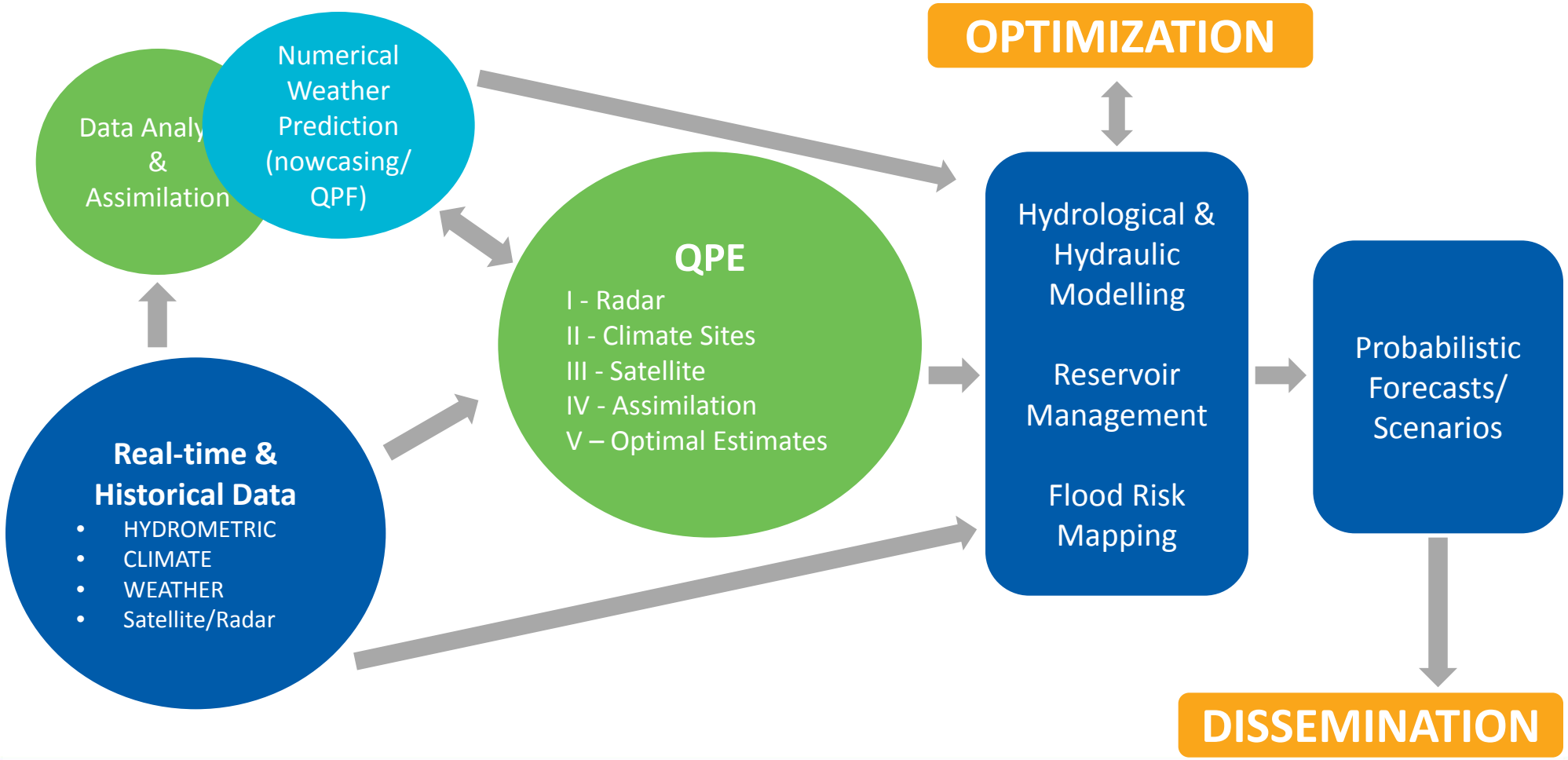
Green color boxes represent the domains of existing SWFDP regional subprojects. Pink and Red color boxes signify the regions for future SWFDP subprojects which will be developed within next 1-2 years and 3-5 years respectively.

Contributing Global Centres, Regional Specialized Meteorological Centres (RSMCs), RSMCs for Tropical Cyclones (RSMCs TC), Regional Forecast Support Centres (RFSCs), and Regional Forecast Support Facilities (RFSFs) are also shown for each of the SWFDP regional subprojects.

Commission for Hydrology - 15

- (e) Implementation Strategy for the End-to-End Early Warning Systems (E2E EWS) for flood forecasting (using the Community of Practice approach): **develop assessment guidelines for NHSs to evaluate their E2E EWS for flood forecasting, furthering the earlier work on "Efficiency of flood forecasting services" (including testing developed procedures) possibly through the establishment of a Task Team/Working Group, consistent with the FFI-AG Work Plan of 2016-2019**, develop access to the interoperable technologies including platforms and models for use in flood forecasting; provide access to training and guidance material, in conjunction with item 1.4(g) below, on the aforementioned items; and assist in the development of projects;

E2E EWS for Flood Forecasting



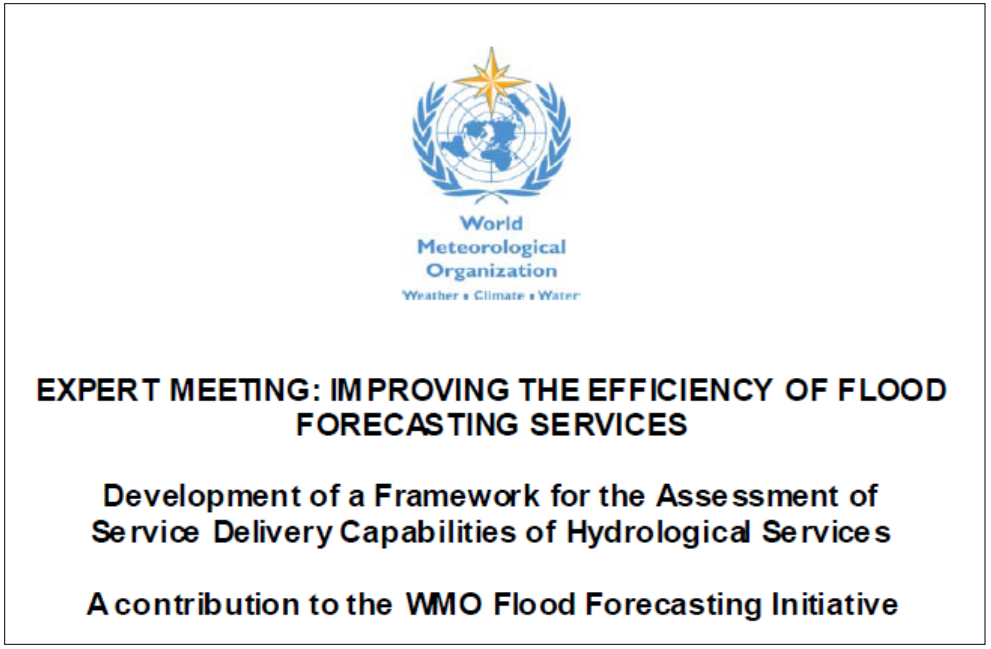
The CHy Assessment Guidelines

- Assessment of a NHS's state towards implementation/improvement of its E2E EWS for FF
  - any types of flood
  - any mechanisms involved
  - any domain (region – trounsboundary/national/basin/subbasin scale)

Goals and technique of the Assessment Guidelines

- build a full picture of a region/NHS's/basin capabilities to implement/develop E2E EWS for Flood Forecasting;
- reveal deficiencies (objective approach – independent on the evaluator experience);
- evaluator – WMO/OPACHE/NHS's/Independent …
- technique – tables in excel, access format
- result – evaluation report
- recommend/point to the possible way to overcome of the found constraints (linkages with other elements of the CoP);

Previous effort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EXPERT MEETING: IMPROVING THE EFFICIENCY OF FLOOD FORECASTING SERVICES

Development of a Framework for the Assessment of Service Delivery Capabilities of Hydrological Services

A contribution to the WMO Flood Forecasting Initiative

2011, 2013: Expert Meetings: Improving the efficiency of Flood Forecasting Services

Outcomes:

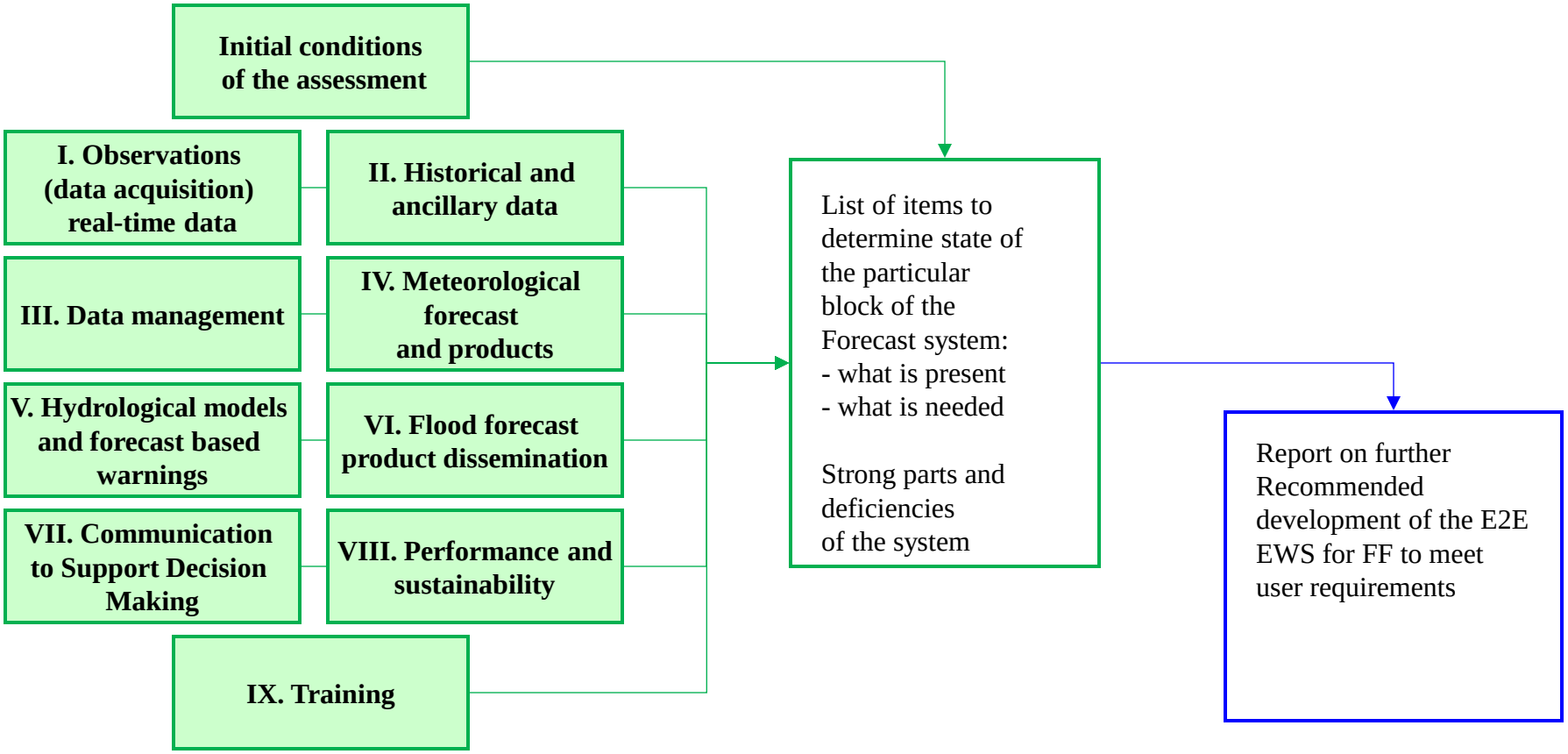
- structure of the Framework
- grading scheme

Inputs to present study:

- some items are used as the basis for the new Assessment Guidelines

Structure of the Assessment Guidelines

Components of the Assessment reflects structure (every chain) of the End-to-End Early Warning System for Flood Forecasting



Composition of the Task Team

Name	Insitution
Angela Corina	Hydrologic Advisor of Italy
John Fenwick	NIWA of New Zealand
Leandro Giordano (Formal Member) and Juan Bianchi (Informal Member)	Instituto Nacional del Agua, Argentina
Liu Zhiyu	Hydrological Forecast Center, Ministry of Water Resources of China
Paolo Reggiani	University of Siegen, Germany
Reggina Cabrera	Southeast River Forecast Center NOAA/National Weather Service, USA
Yuri Simonov	Hydrometeorological Research Centre of Russia

Application of the Assessment Guidelines

1. Preliminary assessment of the domain (off-line)
   - filling preamble of the Assessment Guidelines (AG)
     - physiographic features …
     - flood triggers
     - types of floods
2. Defining subdomain for every type of a flood within main domain
3. Filling the AG matrix for every type of a flood and its subdomain
   - Specific items (questions) for every type of a flood
4. Evaluating results of the assessment
   - Binary grading scheme (yes/no) with comments if “no”
   - Expertise required on this step!

Interoperable models and platforms

Making access to:

– models (hydrologic, hydraulic, reservoir)

– platforms

Development of criteria and template

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

Hydrologic Model Template

Short Name	. HBV
Long Name	. Hydrologiska Byråns Vattenbalansavdelning model
Model Type	. Continuous, semi-distributed model
Usage	. 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	. 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

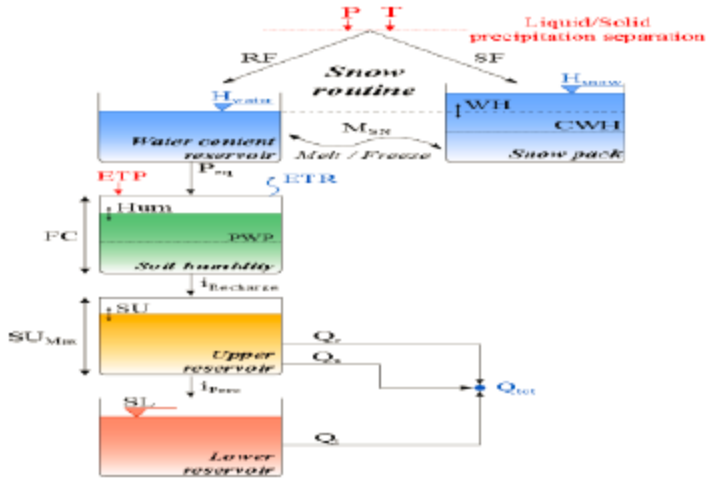
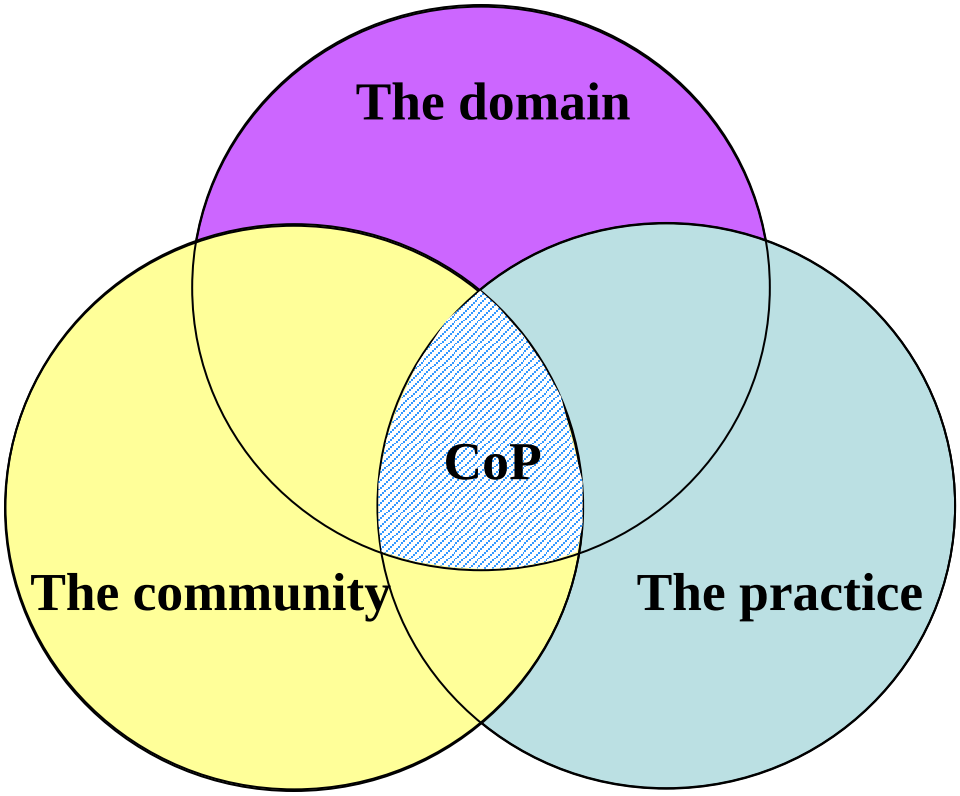
Latest Update & Version	.1996?
References	.Bergstrom, S. (1995) The HBV Model. In V.P. Singh (Ed.) Computer models of watershed hydrology, pp. 443-476, Water Resources Publications, Highland Ranch, Colorado, USA.
Contact Organization	.https://www.smhi.se/en/services/professional-services/energy/hbv-state-of-the-art-hydrological-modelling-1.7540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

Table update 14 Nov 2017

Characteristics of a Community of Practice



The domain: members are brought together by a **learning need they share** (whether this shared learning need is explicit or not and whether learning is the motivation for their coming together or a by-product of it)

The community: their **collective learning** becomes a bond among them over time (experienced in various ways and thus not a source of homogeneity)

The practice: their **interactions** produce resources that **affect their practice** (whether they engage in actual practice together or separately).

Linkages between CHy flood forecasting activities and RAVI

1. Application of the Assessment Guidelines in RAVI:
   - SEE MHEWS A
   - Other?
2. Making access to the hydrological models and platforms
   - Survey each NHSs flood forecasting model (including hydrological, hydraulic, reservoir, platform).

     An email will be sent to each WMO Member.

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

Thank you

WMO OMM

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