

# South East European Multihazard Early Warning Advisory System (SEE-MHEWS)

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WMO Secretariat



**WMO OMM**

World Meteorological Organization  
Organisation météorologique mondiale

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# Content

1. Intro to SEE-MHEWS Initiative (What we try to do? Why?)
2. What kind of collaboration countries might need? What we consider as an Advisory System?
3. How to make the Advisory system? Implementation Plan.
4. Requirements for collaboration in Europe: European NWP Consortia and EMIs possible contribution - who else? US?
5. Which countries will benefit? ... ('different tiers').
6. GMAS as a broader framework: SEE-MHEWS a pilot GMAS project
7. Summary/Conclusion

# Hazards in South-East Europe

South East Europe (SEE) region is

- **highly diverse** in terms of geography and climate
  - **exposed** to a range of **similar natural hazards**
- Heavy precipitation causing floods and landslides
  - Droughts
  - Forest fires
  - Earthquakes
  - Prolonged cold and heat waves
  - Severe thunderstorms and hailstorms



WMO/UNISDR/IPA Project

“Building Resilience to Disasters in Western Balkans and Turkey”

**Beneficiary Countries**

Unprecedented rainfall in May resulted in the worst floods the region has seen in more than 100 years. In Bosnia and Herzegovina, these floods killed more than 20 people and displaced a further 90,000 and resulted in billions of dollars in damages across the region. The floods are estimated to have cost the country some 15% of overall GDP in lost output and damages. In Serbia, the overall damage from these floods is estimated at around 4.7%. Nearly every segment of the economy was negatively impacted by these floods.

Many HydroMet services in SEE not fully ready to support their DRM agencies.

We focus at the level of NMHS trying to support them by advisories to fulfill their mandates.

# CONCLUSIONS FROM IPA PROJECT AND UNHCR-WMO ACTIVITY

- Virtual Center preferred way of sub-regional activities due to strong political background of collaboration in past decades.
- Strong need to move-on from quasi-operational work in Earth System forecasting. MHEWS could substantially help in moving from research towards operations.
- Urgent need to set-up the MHEWS in South East Europe (hydrometeo in start). Virtual collaboration envisaged. E.g. flooding 2014 (huge economic damage), repeated in 2016
- Further encourage development of genuine multi-hazard, multi disciplinary partnerships.

# Identified Requirements in EWS – Common Needs <sup>23/21</sup>

In most of the Beneficiaries of the IPA Project “*Building Resilience to Disasters in Western Balkans and Turkey*” the following requirements were *analyzed*

- **Enabling Environment for DRR**
- **Relationship between the Key Stakeholders and Decision Makers in MHEWS**
- **Operational Cooperation between the DRM agencies and NMHS services**
- **Technical Capacities of NMHs in support to MHEWS**

*It is identified that further work in all of them is needed*

# Technical Capacities of NMHS in support to MHEWS<sup>24/21</sup>

- Need to enhance the **meteorological and hydrological observation networks**, including establishing the **weather radar systems**
- Need to develop **forecasting capabilities** (*meteorological and hydrological*)
- Need to improve **upper air observations**
- Striving to become a **member of ECMWF**, and utilize other opportunities under the **EUMETNET** (*OPERA, C-SRNWP, etc.*) will *contribute* to developing capacities in NWP and *other areas* of NMHS mandate
- Further improve the **climate watch system**, and the **agro-meteorological observation network** and *practice*
- Need to improve NMHSs' **IT sectors**, including **High performance computing capability**
- Need to enhance the sub-regional **data exchange**

# Technical Capacities of NMHS in support to MHEWS<sup>25/21</sup>

## Synergies with

- **regional** (e.g: *ICPDR, ISRBC, RIC, DMCSEE, EMCC and SEEVCCC*) met structures, and
- **European** (*EUMETSAT, ECMWF, EUMETNET, JRC, Copernicus, etc.*) meteorological structures and initiatives, together with the
- overarching programs under the **UN** (e.g. *WMO, UNISDR, UNFCCC, UNCCD*)

proved to be an effective means of **cooperation** in the perspective of MHEWS

It is *recommended* to further expand this collaboration, utilizing the opportunities under the **EU framework** (*IPA, Horizon 2020 research program, etc.*)

# Conclusions & Recommendations

- ❖ **Cooperation is necessary:** Knowing that governments are confronted with serious budget cuts, affecting severely the human resources and infrastructural developments, Informal Conference of SEE NMHS Directors (ICSEED) concluded that collaborative efforts in SEE should be explored as an important means to alleviate this threat.
- ❖ Historical turmoil defines the **virtual networks as preferred way of collaboration** in this sub-region (strong political background of collaboration in past decades) - e.g. South East Europe already runs the network of National Climate Centers (SEECOF, SEEVCCC network) under the RCC-Network in RA VI
- ❖ Strong need **to move-on from quasi-operational work to operations** (e.g. in Earth System forecasting. Support SEE in going from research towards operations).
- ❖ **Urgent need to set-up the MHEWS Advisory System in South East Europe** (Hydrology and Meteorology in beginning).  
e.g. flooding 2014 (huge economic damage between 3 and 4 billion euro), repeated in March 2016 (to a lesser extent).

# Regional MHEWS Cooperative Mechanism for SEE<sup>27/21</sup>

## SEE-MHEWS

- **Design** of the **observation networks** (*meteorological and hydrological*) could be optimized provided that *effective data exchange* is in place
- Hydro-meteorological services and DRM agencies could *benefit* from improved information sharing and collaborative joint work in the region
- “**One stop shop**” for *diverse analyses*, different *models* output *data*, and *remote sensing observations* for the benefit of **shift forecasters** throughout SEE
- **Authorized Password** protected **access** to the **ICT platform** *approved by Intergovernmental Agreement*, including the Data Policy Agreement
- **Warnings** *produced and issued* at the level of **NMHS/DRM** where **SEE-MHEWS** serves as **Advisory system** for **forecasters** supported by *EMI, Regional Centers, NMHSs, etc.*



# SRNWP Consortia in Europe



## ALADIN

Algeria  
Belgium  
Bulgaria  
France  
Morocco  
Poland  
Portugal  
Tunisia  
Turkey

Austria  
Croatia  
Czech Rep.  
Hungary  
Romania  
Slovakia  
Slovenia



## SEE COP

Albania  
Bosnia-Herzegovina  
The FYROM  
Montenegro  
Serbia



## HIRLAM

Denmark  
Estonia  
Finland  
Iceland  
Ireland  
Lithuania  
Netherlands  
Norway  
Spain  
Sweden



UKMO  
United Kingdom

## COSMO

Germany  
Greece  
Israel  
Italy  
Poland  
Romania  
Russia  
Switzerland



# SOUTH EAST EUROPE MEMBERS TO ECMWF

ECMWF has 22 Member States and 12 Co-operating States

## Member States

Austria, Belgium, **Croatia**, Denmark, Finland, France, Germany, **Greece**, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, **Serbia**, **Slovenia**, Spain, Sweden, Switzerland, **Turkey** and the United Kingdom

**(five member states from SEE)**

## Co-operating States

**Bulgaria**, Czech Republic, Estonia, **the former Yugoslav Republic of Macedonia**, **Hungary**, Israel, Latvia, Lithuania, **Montenegro**, Morocco, **Romania** and Slovakia.

**(five co-operating states from SEE)**

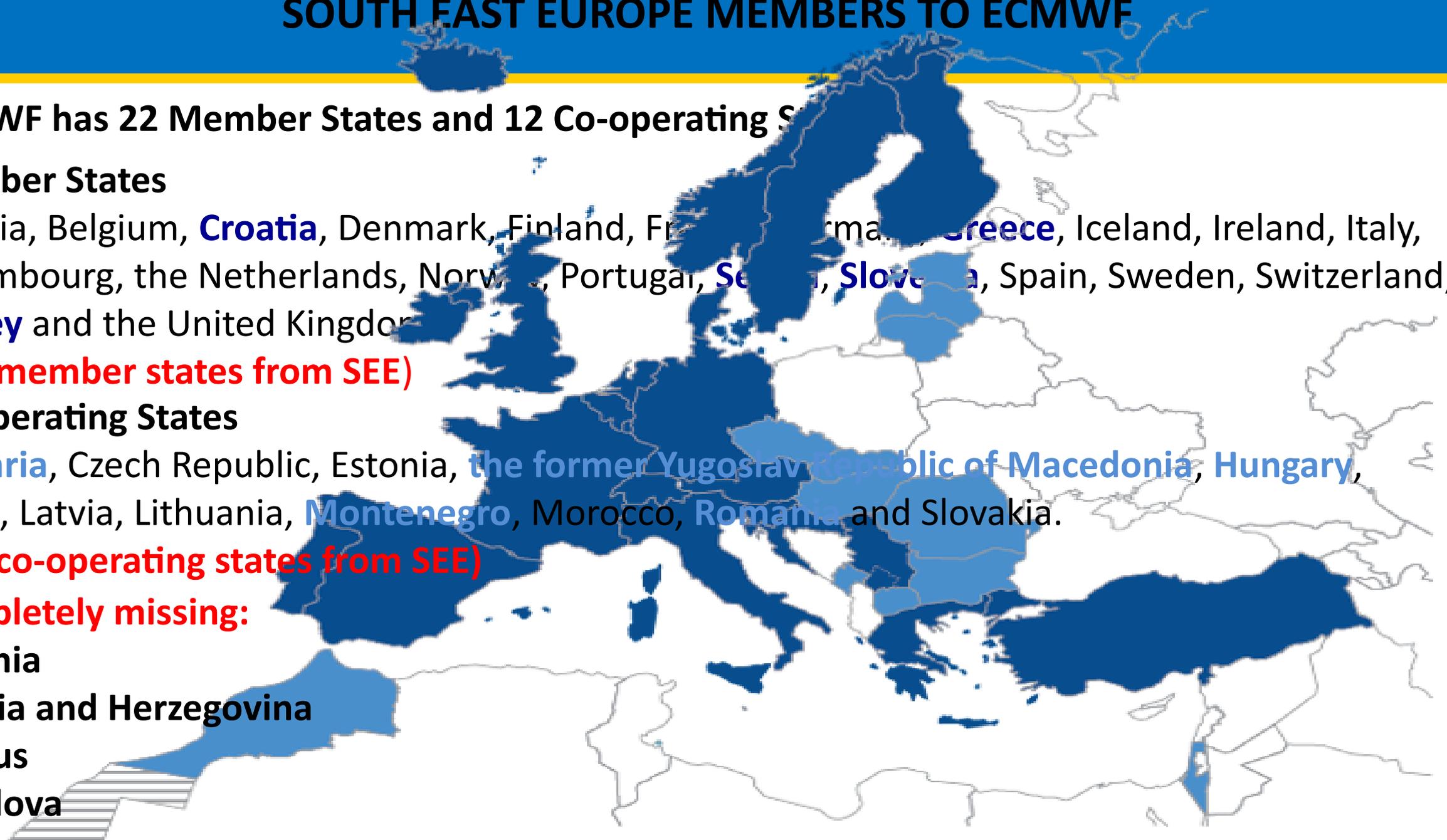
## Completely missing:

**Albania**

**Bosnia and Herzegovina**

**Cyprus**

**Moldova**





## WAY AHEAD

- **Sustain and continue**, *keep momentum* and build on achievements
- Keep focus on major hazards
- *Streamline and leverage development actions* to ensure interoperability and **seamlessness** by the *WMO guidance and assistance*
- Address the **technological gaps** of the hydro-meteorological systems at *national and regional level* by *focused projects*
- Future projects to be **scalable** and **innovative** – introduce **new concepts** and **services** ( e.g. *impact-oriented service*)

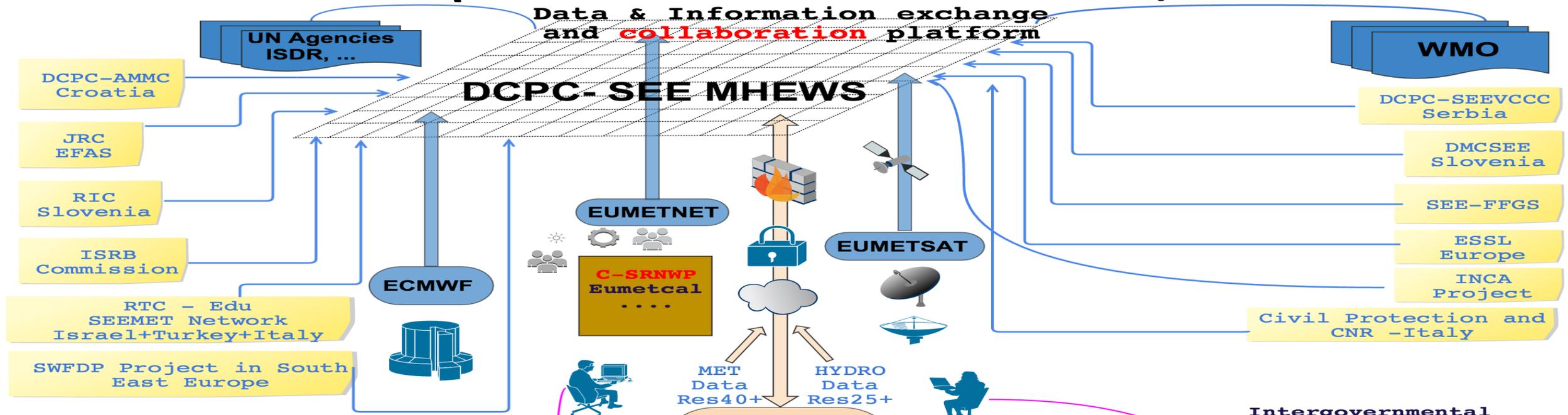


## WAY AHEAD

- *Continue* working on institutional arrangements through the **role** of the **NMHSs** as **key enablers** for *successful DRR*
- *Address* further procedural aspects, data policy, quality management
- *Maintain* and *enhance* the relations with the DRR stakeholders by developing the *concept* of **Collaborative Decision Making**
- *Utilize* the **potential** of the European Meteorological Infrastructure
- *Build* a **strategy** for resolving the NMHS's **resources deficits** – *financial, technical, human!!*

# MHEWS Advisory System

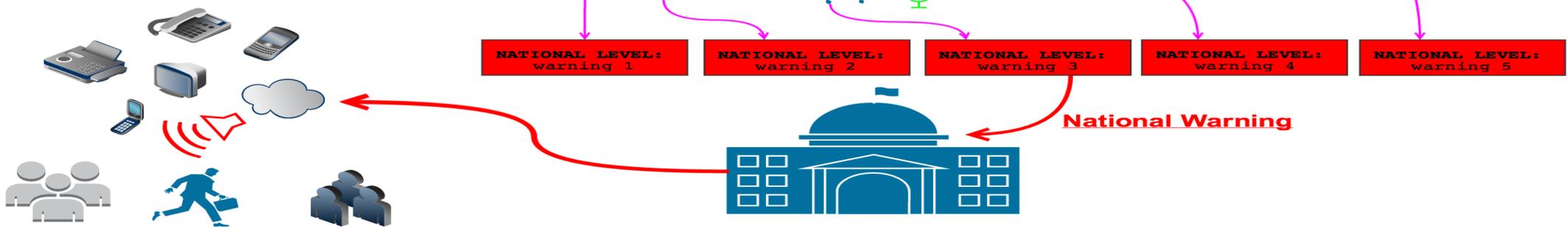
(DISTRIBUTED NETWORK IN SEE)



## MHEWS in SEE: VISION

? Regional WIGOS Center-Network ?

Intergovernmental Agreement (including Data Policy Agreement) between interested South East European Countries



# SEE-MHEWS-A Implementation Plan



**WMO OMM**

World Meteorological Organization  
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# PROJECT HIGHLIGHTS

- **Overall Objective:** Achieved better collaboration between the NMHS, which will contribute to improved protection of life and property in South-East Europe.

- **Main outputs:**

Detailed implementation plan for a regionally owned Multi-Hazard Early Warning Advisory System (SEE-MHEWS-A) prepared, and adopted by NMHS directors.

Consensus of Directors of participating NMHS on the scope and technical content of the SEE-MHEWS-A;

- **Implementing organization:** WMO, project coordination by FMI

- **Funding:** USAID, 580 000 USD

- **Implementation period:** 12 months, September 2016 – August 2017

# PROJECT PARTNERS

## **Participating meteorological and hydrological services during the 1<sup>st</sup> Phase:**

Albania, Bosnia and Herzegovina, Croatia, Montenegro, Kosovo (UNSCR 1244/99), the former Yugoslav Republic of Macedonia, Serbia, Turkey, Slovenia, Bulgaria, Greece, Cyprus, Hungary, Romania, Moldova, Ukraine, Israel, Jordan and Lebanon.

## **Collaborators:**

ECMWF, EUMETNET, EUMETSAT, ESSL, JRC, Copernicus, ISRBC, DMCSEE, SEEVCCC, RIC, Euro-Mediterranean Center on Climate Change, NWP consortia, European NMHSs etc.

# BACKGROUND

- Develop SEE-MHEWS-A Implementation Plan (IP) based on recommendations made at the SEE-MHEWS-A technical workshops
- Three workshops held:
  - SEE-MHEWS-A Forecasters Workshop, 7-9 Feb. 2017
  - SEE-MHEWS-A NWP Modelling Workshop, 8-9 March 2017
  - SEE-MHEWS-A ICT & OBS Workshop, 4-6 April 2017
  - Final reports available at: <https://public.wmo.int/en/projects/see-mhews-a>
  - 127 participants and 28 international experts participated in the workshops
  - Discussions and contributions by potential contributing stakeholders (not all) for the design of the System
- Implementation Plan
  - Version 0.3 (final draft for consideration)
  - Several degrees of freedom and quite a few scenarios are possible
  - Project management structure to advice on pathway leading to a best possible (cost-effective) system design
  - So far 22 potential project participants (meteorological, hydrometeorological and hydrological services)
  - So far 38 potential contributing stakeholders identified
  - Living document

# IMPLEMENTATION PLAN

## 1. Purpose of this Document

## 2. Introduction

- Rationale for SEE-MHEWS-A
- Objectives
- Major Hazards
- Project Management Overview
- Description of Implementation

## 3. Key Activities for SEE-MHWES-A Implementation

- Management of SEE-MHEWS-A Implementation
- Sub-Regional and RA VI Collaboration
- Collaboration with other relevant WMO projects and activities
- Observations
- Forecasting and Modelling
- Information and Communication

## 4. Implementation

- Activities, Deliverables (Table 4.1), Milestones, Costs (Table 4.2) and Risks

## 5. Capacity Development and Implementation Requirements by Project Participants needed to fully benefit from the Advisory System

## 6. Resources

## 7. Risks and Mitigation

Appendix 1: Regional Requirements for Observational Data and Products

Appendix 2: Regional Forecasters' Requirements for Model Outputs

Appendix 3: Summary of Proposal and Comments by Potential Contributing Stakeholders

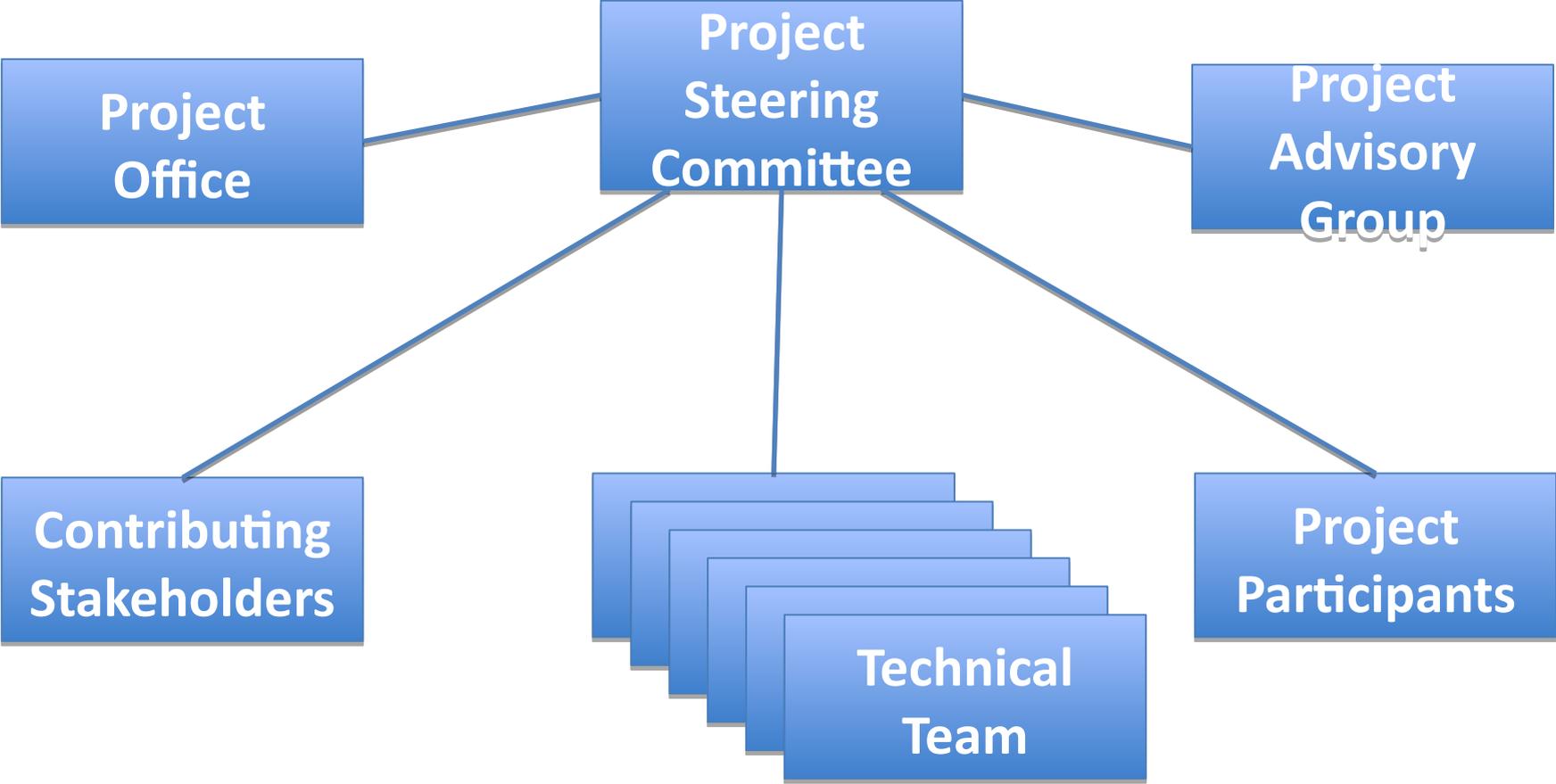
Appendix 4: Telecommunication Capabilities

Appendix 5: List of Acronyms

# TIMELINE OF IMPLEMENTATION

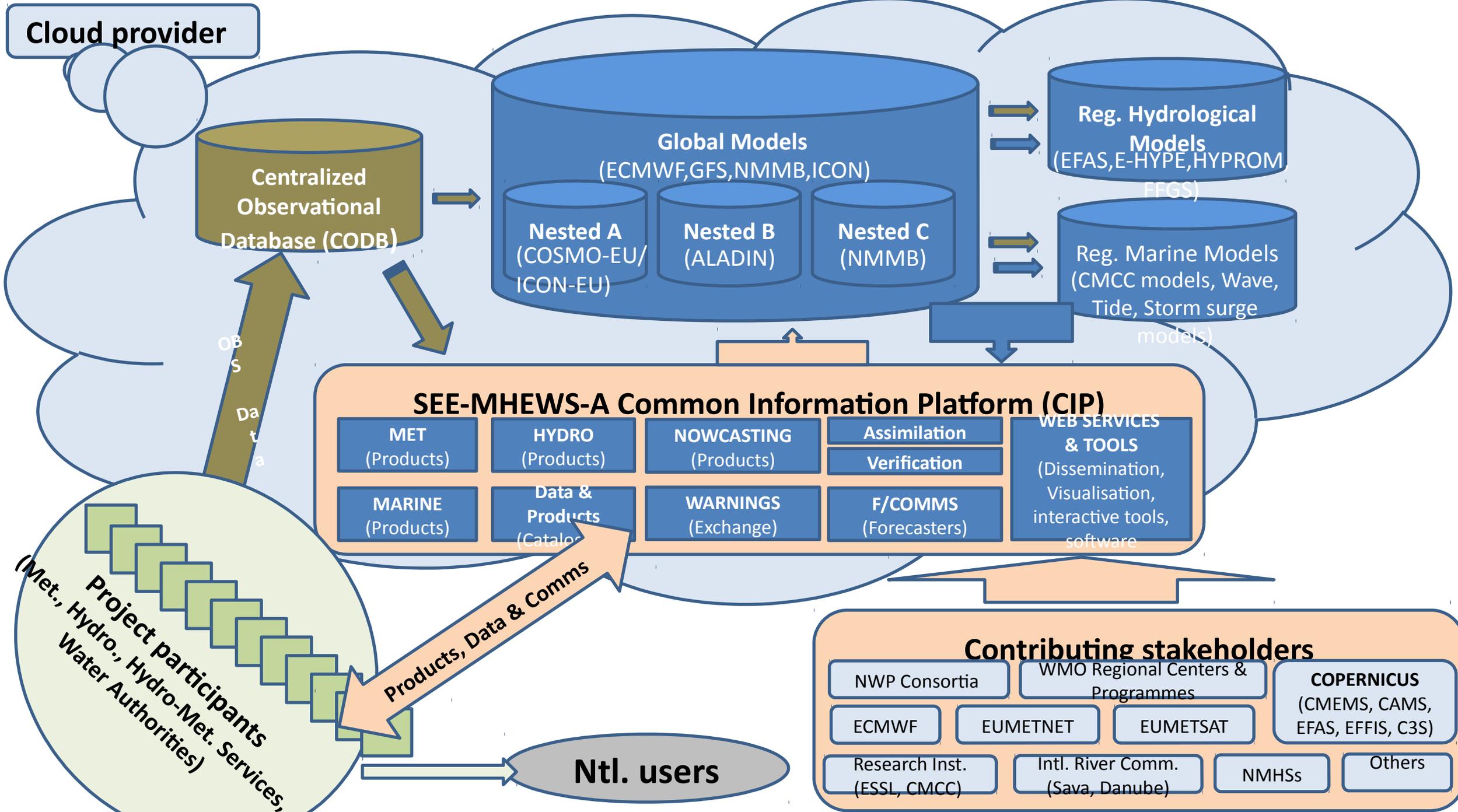
- **Development Phase** (mid-2016 to mid-2017)
- **Resource Mobilization Phase** (mid-2017 to end-2017)
- **Implementation Phase** (2018 - 2022)
- **Testing Phase** (January - June 2023)
- **Operational Phase** (mid-2023 onwards)

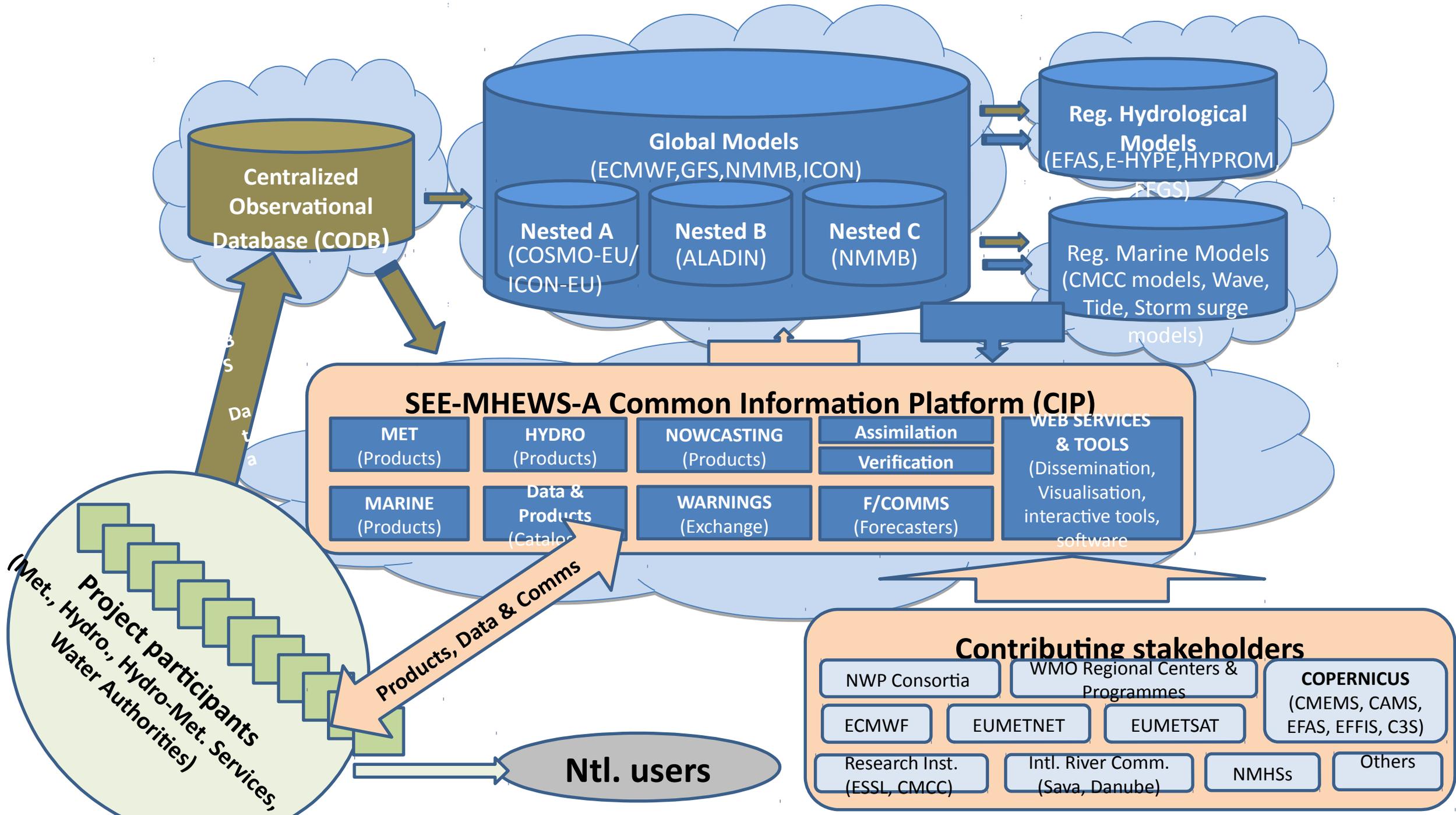
# PROJECT MANAGEMENT STRUCTURE

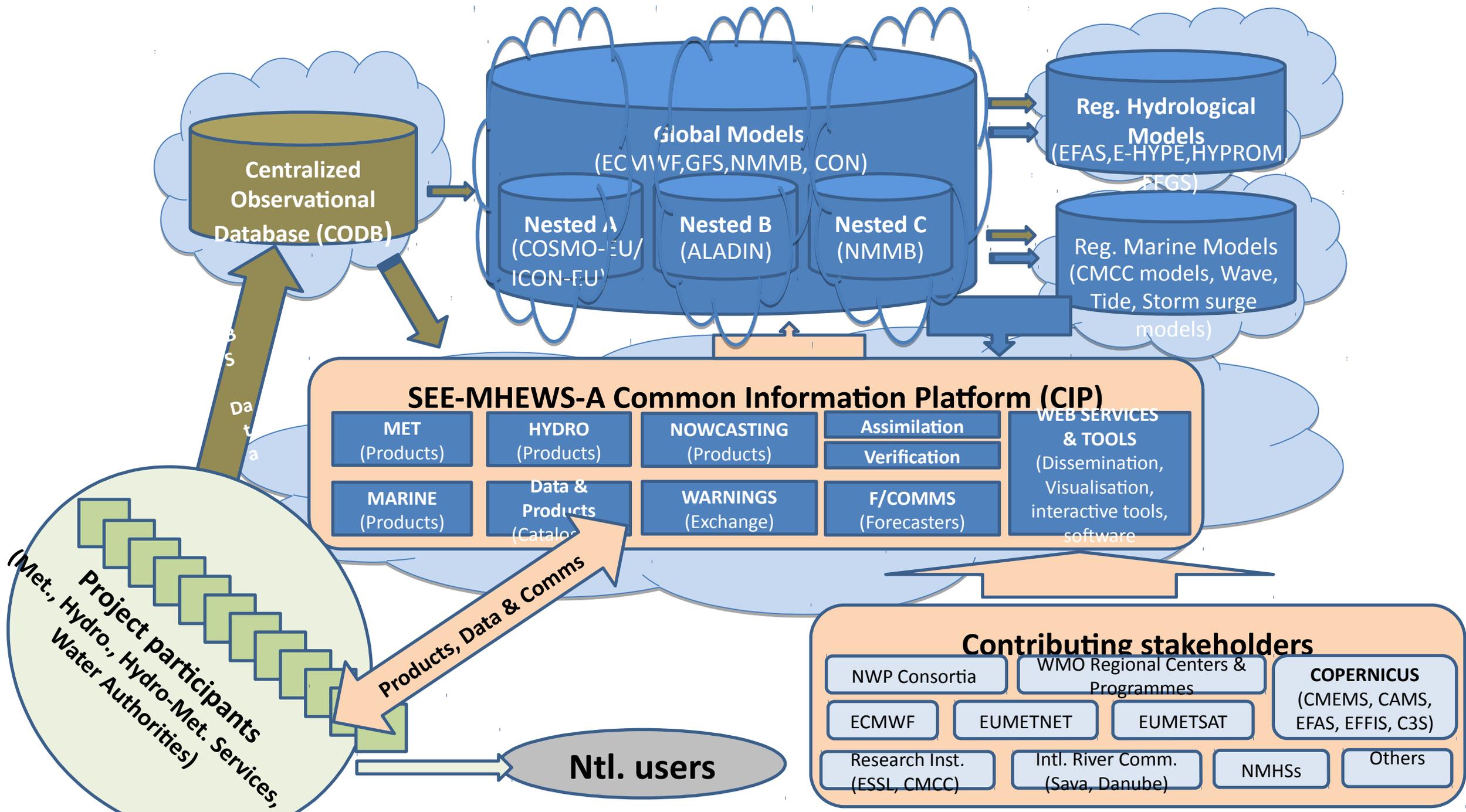


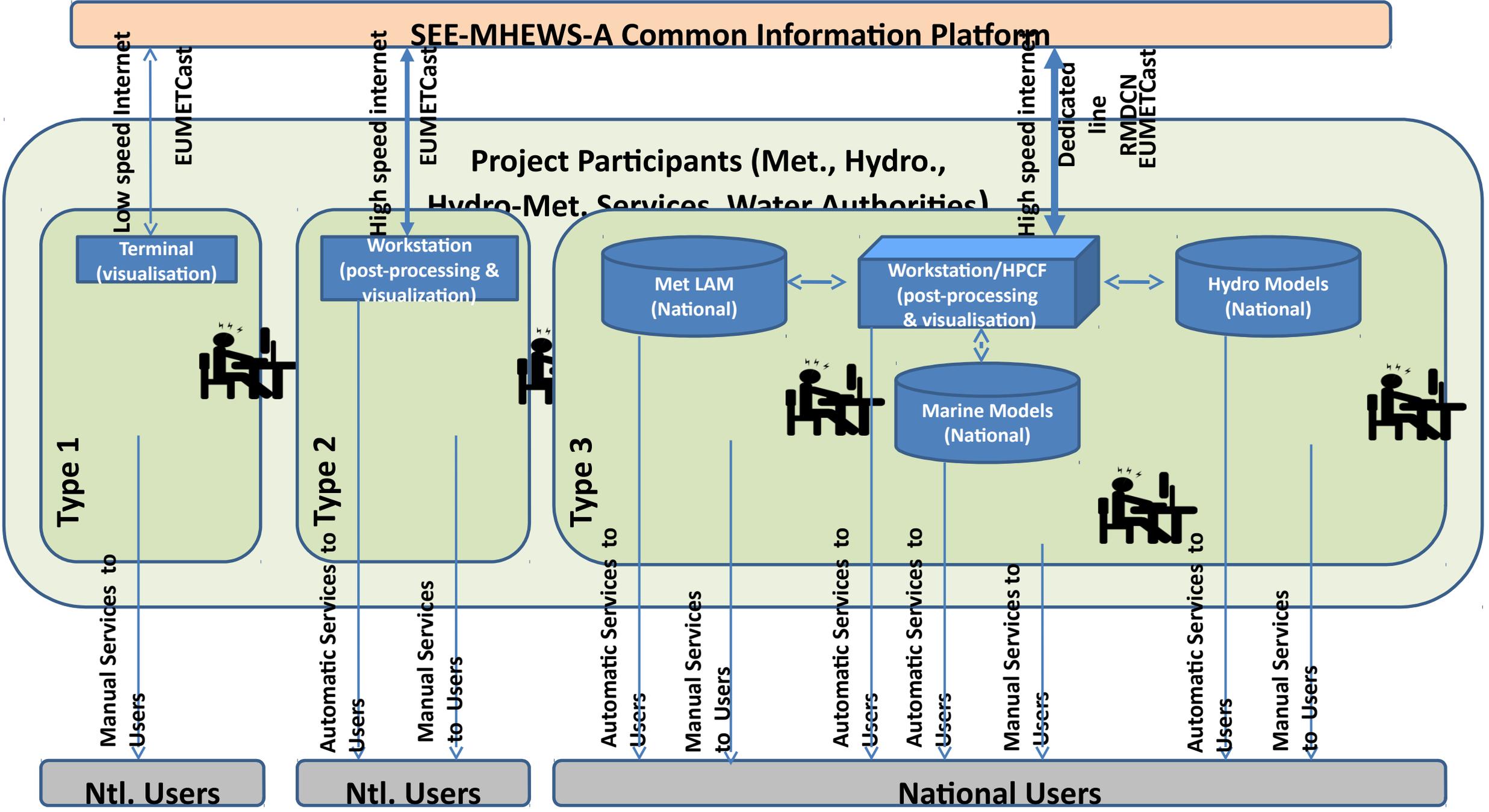
# SYSTEM DESIGN

- Follows the **outcomes** of the three Project Workshops
- **Envisaged design** is to be implemented until 2023 when the SEE-MHEWS-A may become operational, and includes e.g.:
  - **Use of cloud services**
  - Sub-regional (joint operations) complementing national approach to operational activities
  - Reducing the differences in the sub-regional operational capacities
- Design is based on several **assumptions** that should be considered by the project management, such as:
  - Agreements with potential contributing stakeholders, e.g. NWP consortia or potential cloud services providers



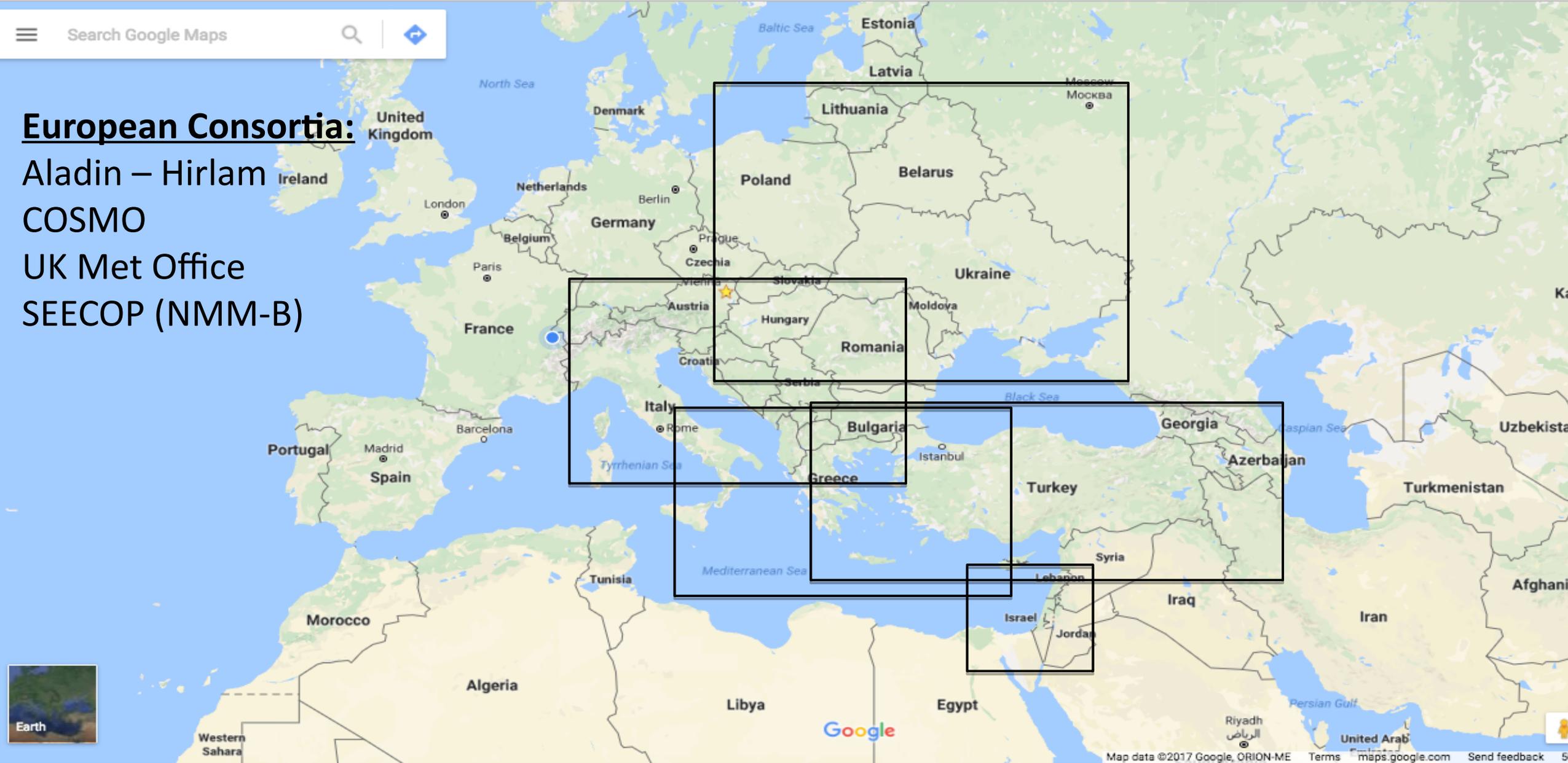




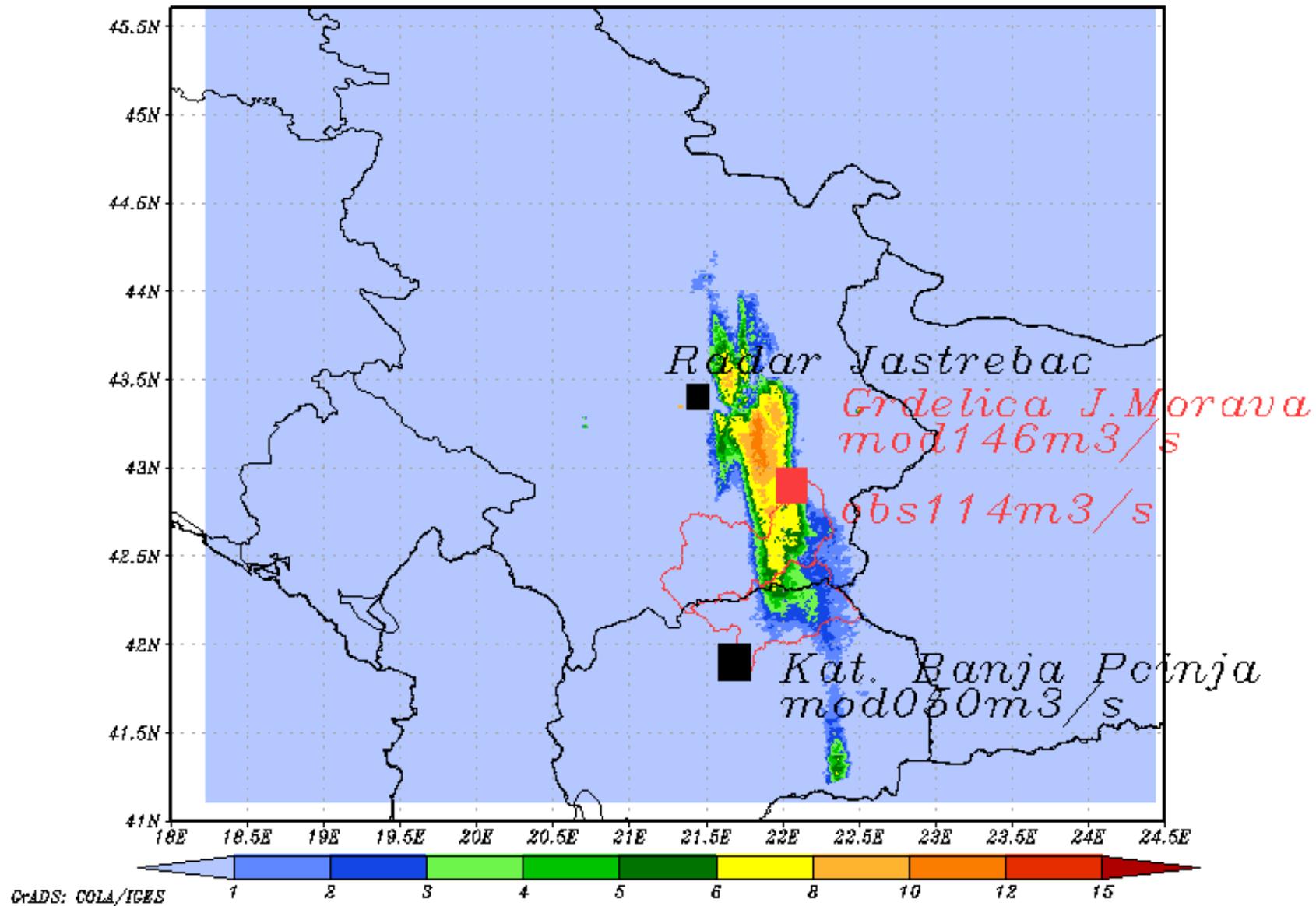


# European Consortia:

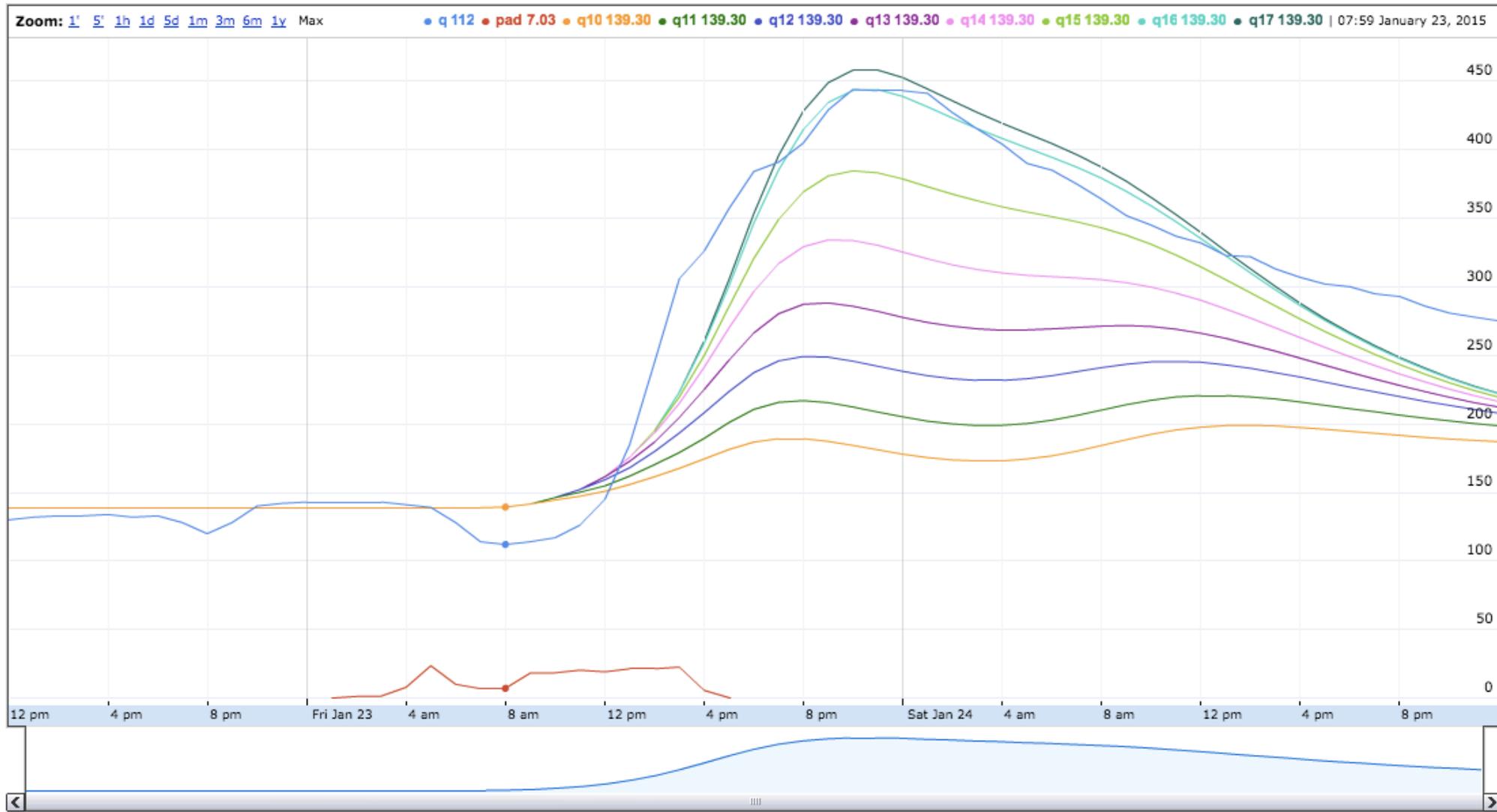
- Aladin – Hirlam
- COSMO
- UK Met Office
- SEECOP (NMM-B)



*Jastrebac Radar Rainfall [mm/hour] 23JAN2015 09:00 - 10:00*  
*Discharge (m<sup>3</sup>/s) at Grdelica(J.Morava) and Kat. Banja(Pcinja)*



# Grelica River discharge

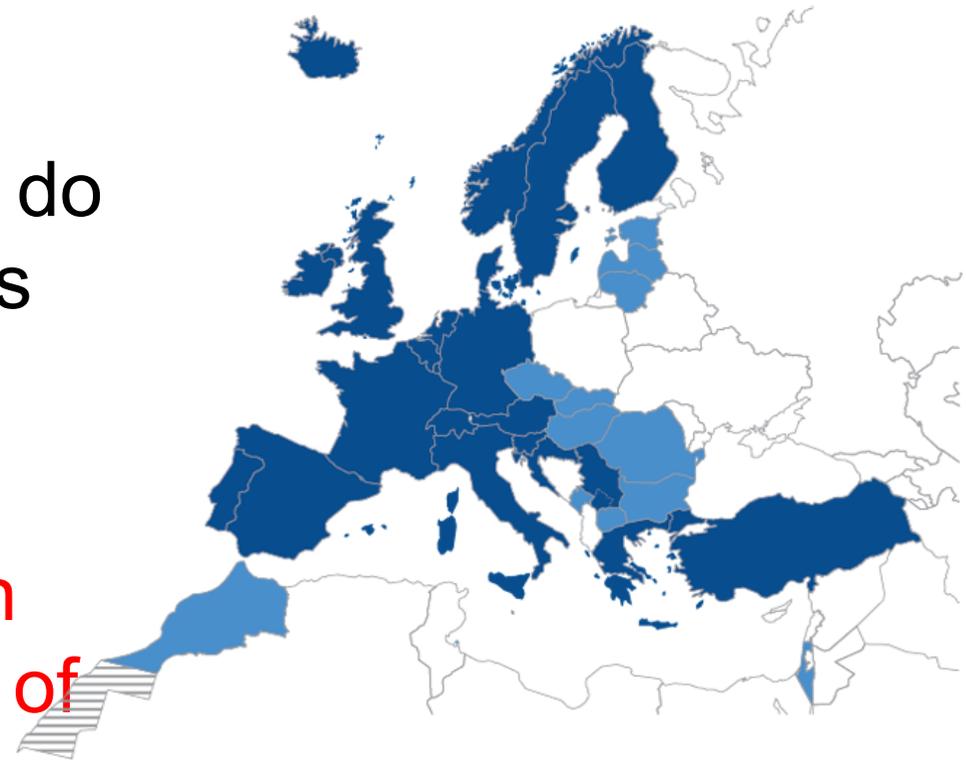


# NEXT STEPS FOR SEE-MHEWS-A PROJECT

- Establishment of WMO Project Office in Croatia, hosted by the Meteorological and Hydrological Service of Croatia (DHMZ). **[Done]**
- Fundraising for further phases of the project (USAID, EU, World Bank, Green Climate Fund and others). **[On-going]**
- Commencement of implementation of the next project phase already close to being agreed (World Bank).
- Cooperation with other relevant projects.

# ECMWF HPCF resources – South East Europe

- Only ECMWF Member States have direct access to HPCF resources.
- ECMWF Cooperating States do not have access to ECMWF's HPCF resources.
- Croatia, Greece, Serbia, Slovenia and Turkey have an aggregated HPCF allocation of ~55 million Cores\*Hours for 2017.

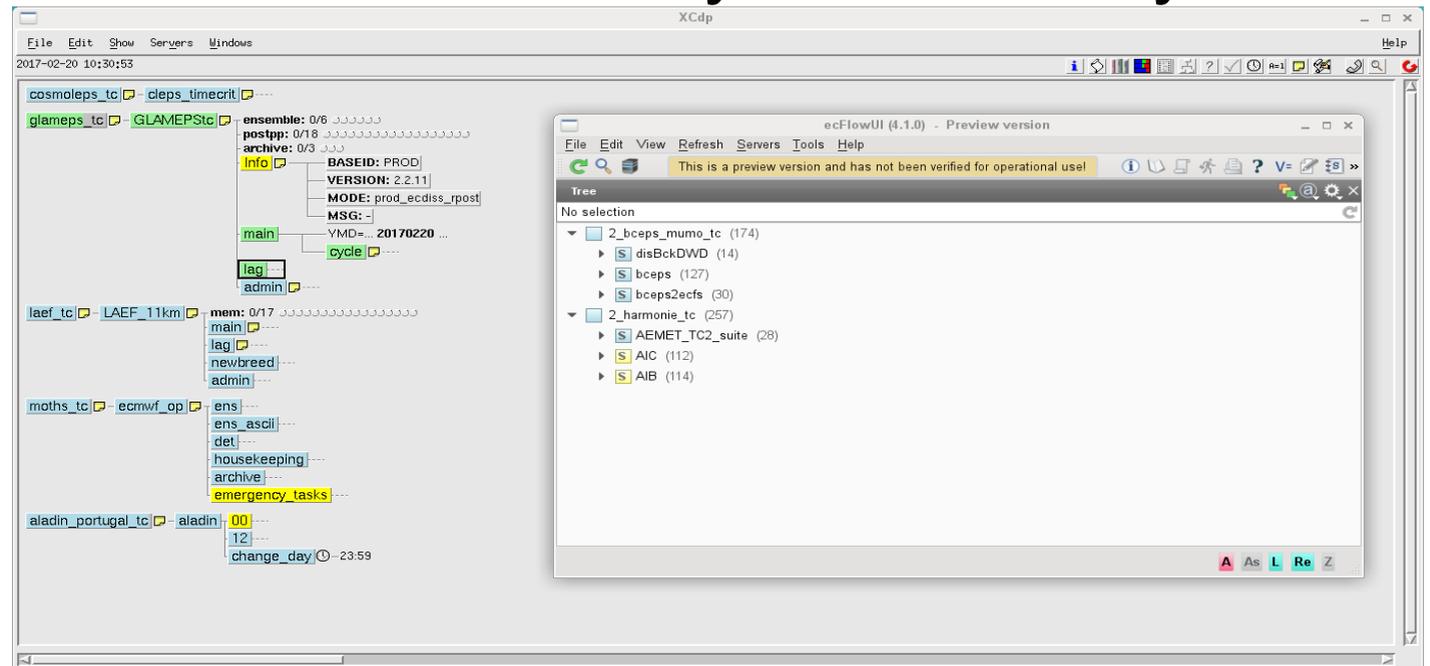


# Member States «operational» activities at ECMWF.

- Service in place since 2006, known as ‘Time critical activities’.
- ECMWF’s work flow management package ecFlow should be used.
- Technical guidelines are provided by ECMWF.
- ECMWF operators will provide monitoring and restart services.
- Enhanced access to ECMWF resources, inspired from ECMWF’s operational environment:
  - Access to high priority queues on the HPCs.
  - Access to duplicated storage systems on the HPCs.

# Member States «operational» activities – COSMO-LEPS

- Activity started in 2002 in research mode and became “operational” in 2006.
- The COSMO-LEPS suite is operated by Italy.
- 20 COSMO members run at 7km for 5 ½ days twice a day.
- HPCF Cost:
  - ~3k Cores\*Hours per run.
- **Annual HPCF cost:**
  - ~2.2M Cores\*Hours.



# «operational» activities – other scenarii

- ECMWF optional program:
  - SEE-MHEWS sets up a “consortium”.
  - One of the ECMWF MS asks ECMWF to run the consortium’s operational HPCF work.
  - Example: Optional BC program.
- Externally funded activity:
  - SEE-MHEWS issues an Invitation To Tender to run its operational HPCF work.
  - ECMWF bids for it, gains the contract and runs your operational work.
  - Examples: EFAS for JRC or Copernicus CAMS and C3S for the European Union.
- These options are more formal, more complex to set up and therefore slower and likely to be more expensive.

# SEE MHEWS-A Project as a Template for Other Regions

- Following the 2016 EC WG DRR recommendation **SEE MHEWS-A project** was successfully **presented** at the
  - ✓ **28<sup>th</sup> Session of Interstate Council on Hydrometeorology of the Commonwealth of Independent States**, Dushanbe, Tajikistan
  - ✓ **President RA I supported an initiative of RA VI on regional collaboration between RA I, RA II and RA VI on MHEWS**
  - ✓ The two meetings of the *WMO SG*, **Mr. Petteri Taalas** with **Mr. Neven Mimica** *European Commissioner for International Cooperation and Development* opened possibility to **expand the EWS implementation initiated by SEE MHEWS-A into Central Asia or Africa** under the **EC DG DEVCO support**
  - ✓ **Multi-Hazard Early Warning Conference, Cancun, Mexico**  
*Session 5: Strengthening regional cooperation and partnerships*



**SEE-MHEWS-A** was successfully **presented** as a **building blok** of the **GMAS - Global Multi Hazard Alert System**



*Final Conference of the Phase I of SEE-MHEWS-A Project, Ljubljana, Slovenia*

# Summary: International Collaboration?

- Joint effort from 5 countries full-members of ECMWF and EMIs+NWP Consortia in Europe could make difference !
- Other non-members could improve (or develop) their national Early Warning Systems based on MHEWS Advisories coming through five-full-member states
- All countries could contribute by exchange more observations through the project and for the project (potentially leading to better quality forecasts)
- SEE-MHEWS-A is a first pilot project for WMO GMAS (Global Multihazard Alert System)

# QUESTIONS & ANSWERS

## 1) Three possible options of operating the prediction models – which of them will be implemented?

### a. **Single Cloud provider hosts all the operations for advisories and National implementations for HYDRO** (Cloud provider e.g. ECMWF, and NMHSs):

ECMWF) - Data collection

ECMWF) - Data assimilation for NWP (global, regional?, now-casting?)

ECMWF) - Global model production (~10km res)

ECMWF) - Regional model production (~4km res)

ECMWF) - Local model production (~1-2km res)

ECMWF) - Hydrology model production

(larger river catchments only, e.g. Sava River, Drina River, ...)

NMHSs) - Small River catchments production at the National MET-HYDRO Services

(based on the binary data inputs from Advisory System), including nowcasting

# QUESTIONS & ANSWERS

## 1) Three possible options of operating the prediction models – which of them will be implemented?

### b. **Different Cloud providers: Option 1** (Cloud provider e.g. RSMC, and ECMWF, and NMHSs):

RSMC) - Data collection

ECMWF) - Data assimilation for NWP

ECMWF) - Global model production

ECMWF) - Regional model production

NMHSs) - Local model production

ECMWF) - Hydrology model production

(larger river catchments only, e.g. Sava River, Drina River, ...)

NMHSs) - Small River catchments production at the National MET-HYDRO Services

(based on the binary data inputs from Advisory System), including nowcasting

# QUESTIONS & ANSWERS

**1) Three possible options of operating the prediction models – which of them will be implemented?**

**c. Different Cloud providers Option 2** (Cloud provider e.g. RSMC, and ECMWF, NWPCons, HYDROCons, and NMHSs):

RSMC) - Data collection

ECMWF) - Data assimilation for NWP

ECMWF) - Global model production

NWPCons) - Regional model production

NWPCons) - Local model production

HYDROCons) - Hydrology model production

(larger river catchments only, e.g. Sava River, Drina River, ...)

NMHSs) - Small River catchments production at the National MET-HYDRO Services (based on the inputs from Advisory System)

# QUESTIONS & ANSWERS

## 2) Where will the code be installed, maintained and run?

The code would be installed, and run at the relevant (Question 1) cloud provider. Update with the new versions would be done from the principal code provider that is one of the nodes from ALADIN, RC LACE consortia, to be agreed by the GA.

# QUESTIONS & ANSWERS

## 3) Who (which entity) will be the partner for agreement?

- The project will try to get the approval from the ECMWF Council for using their supercomputer as a main HPC.
- Agreements with European NWP Consortia will be made, if so decided by Consortia to collaboratively work on installation, running and maintenance (development) of model codes.
- It is to be decided/agreed by the respective Consortium which legal entity will be engaged (particular NMHS as a member of consortium, or another entity decided by GA, e.g. R&D organization)

# QUESTIONS & ANSWERS

## **4) The time scale of cooperation? (the implementation phase 2018-2022, operational phase 2023)**

Development Phase (mid-2016 to mid-2017)

Resource Mobilization Phase (mid-2017 to end-2017)

Implementation Phase (2018 - 2022)

Testing Phase (January - June 2023)

Operational Phase (mid-2023 onwards)

Cntd ->

# QUESTIONS & ANSWERS

## 4) The time scale of cooperation? (the implementation phase 20182022, operational phase 2023)

- Time scale of cooperation depends solely on fund-raising success.
- At the moment WMO is engaged with the World Bank on a project worth 1,5 million USD, that has aim to build a skeleton of the future system and practically prove the concept and provide for quasi-operations for at least one model from European NWP consortia.
- WMO discuss further with the World Bank possibilities for joint engagement in different financial instruments.
- Separately WMO will liaise with European Commission, DG DEVCO (Development of Cooperation) to seek for funding possibilities.

# QUESTIONS & ANSWERS

## 5) Potential benefit of engaging for the NWP Consortia

- Support for further R&D activities as part of the SEE-MHEWS project
- Raise the visibility and importance of investing further in research and integration with the operations
- Spreading the network of researchers and improving(?) the collaboration between consortia
- ... ?

Thank you  
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