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

39th EWGLAM - 24th SRNWP EUMETNET

WMO Secretariat

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

WMO OMM
World Meteorological Organization
Organisation météorologique mondiale

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

2015 GAR

- The 2015 Global Assessment Report on Disaster Risk Reduction (GAR15) has assembled compelling evidence to demonstrate that strengthened commitment to and investment in disaster risk reduction is critical
- Globally, the expected average annual losses (AAL) from earthquakes, tsunamis, tropical cyclones and river flooding are now estimated at US$314 billion in the built environment alone.

The disaster burden is real

The total direct cost of disasters is equivalent to that of major diseases. An average of **42 million human life years** are lost in disasters each year, equivalent to the number of years lost to tuberculosis. This burden is shouldered by those with lower incomes: of all the life years lost, more than **80 per cent are lost** in low and middle-income countries.

Can disaster risk be reduced?

Over the last 10 years, there has been significant progress in developing institutions, policies and legislation for disaster risk reduction.

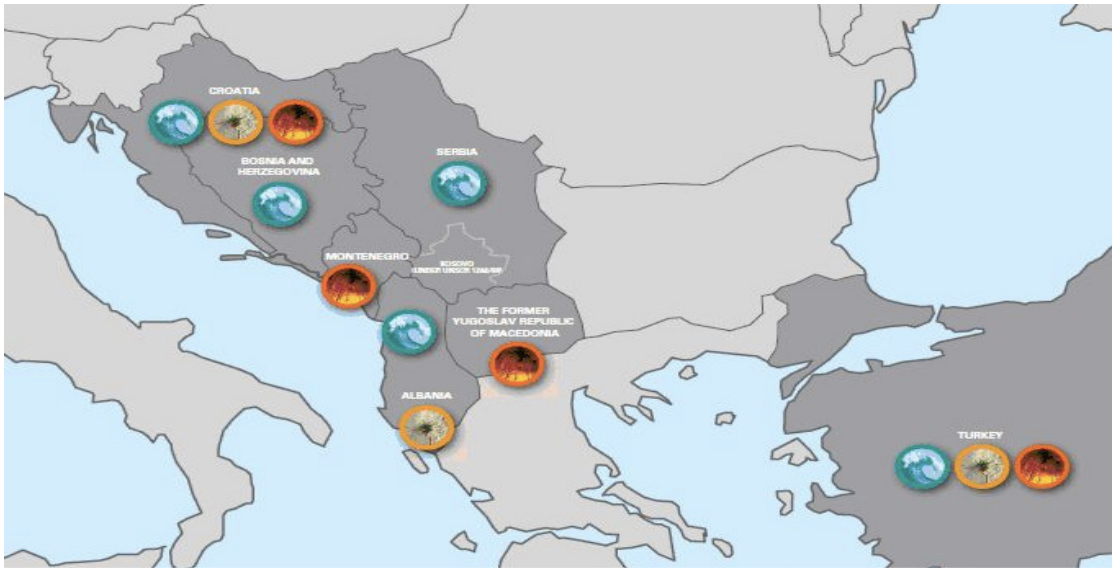
Further, capacities for risk assessment and identification, disaster preparedness, response and early warning capacities and in reducing specific risk have been significantly strengthened.

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

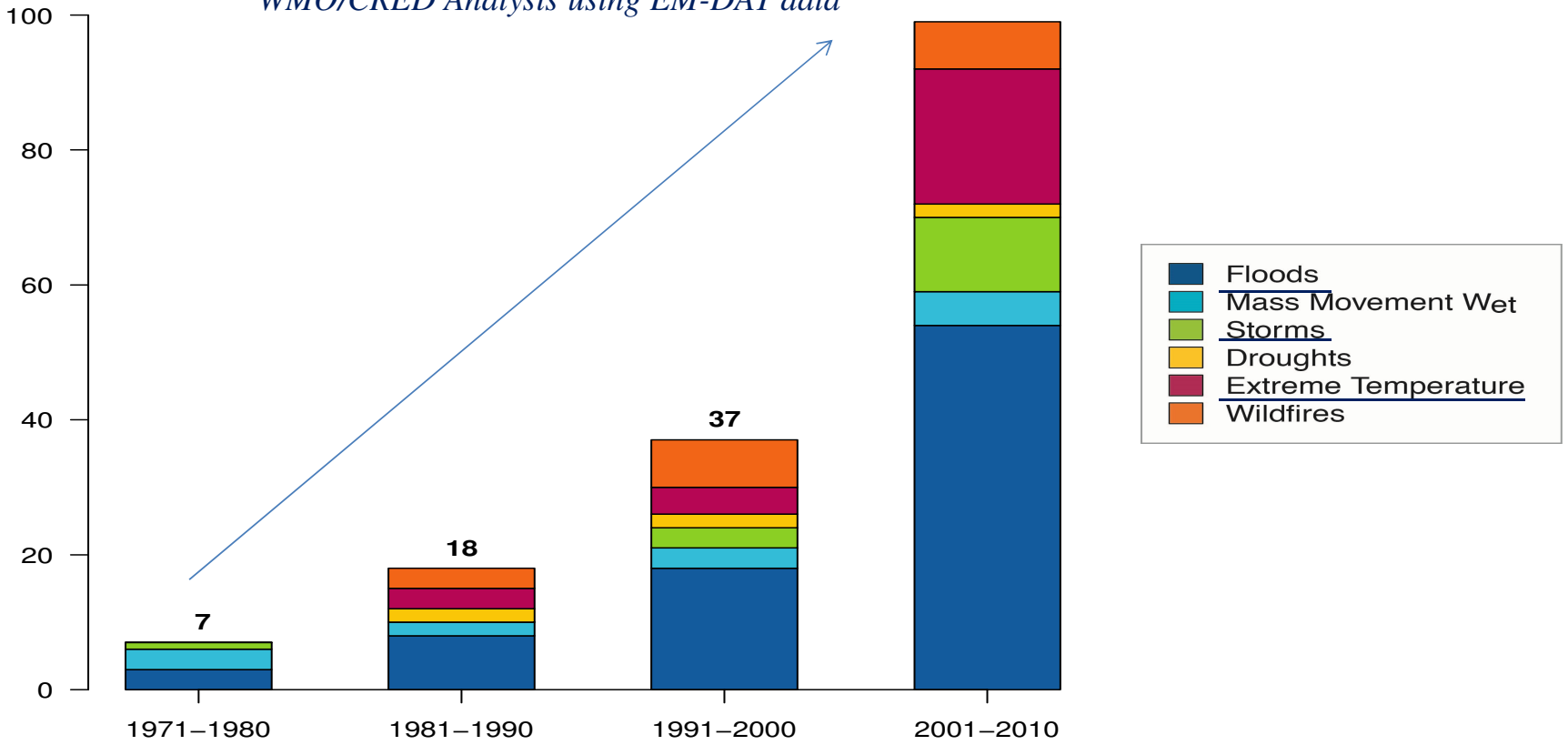


WMO/UNISDR/IPA Project
"Building Resilience to Disasters in Western Balkans and Turkey"
Beneficiary Countries

Hazards in South-East Europe

Number of reported disasters by decade by hazard type (1971–2010)

WMO/CRED Analysis using EM-DAT data



Source: *EM-DAT: The OFDA/CRED International Disaster Database - www.em-dat.be*
Université Catholique de Louvain - Brussels - Belgium

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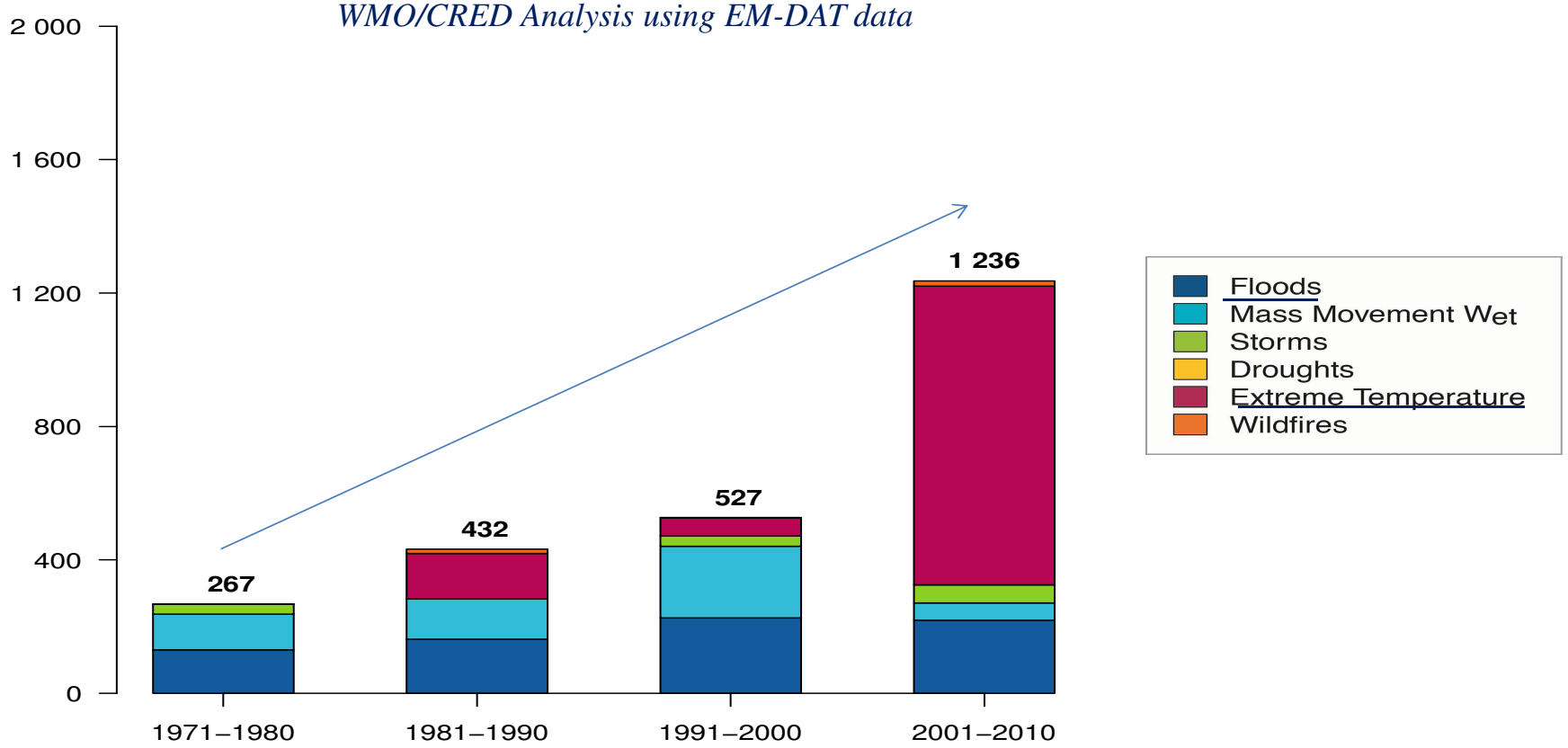

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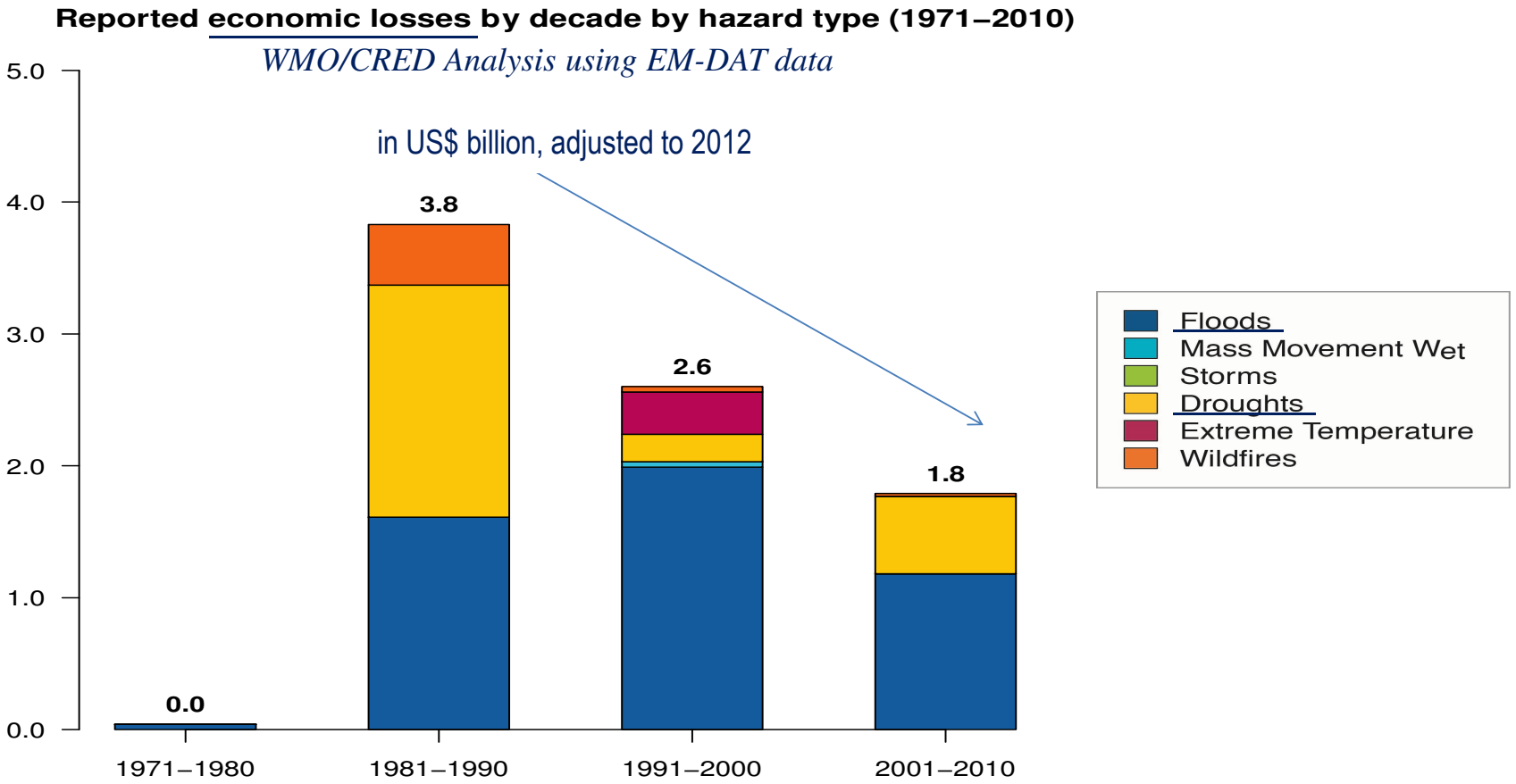
Hazards in South-East Europe



Source: *EM-DAT: The OFDA/CRED International Disaster Database - www.em-dat.be*
Université Catholique de Louvain - Brussels - Belgium

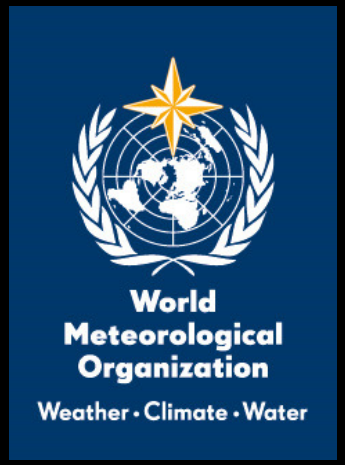
Unprecedented rainfall in May resulted in the worst floods the region has seen in more than 100 years. In Bosnia and Herzegovina, these floods killed more than 20 people and displaced a further 90,000 and resulted in billions of dollars in damages across the region. The floods are estimated to have cost 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.

Disaster risk can be reduced and it **makes good financial sense.** In fact, investing in disaster risk reduction is a precondition for developing sustainably in a changing climate.

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.

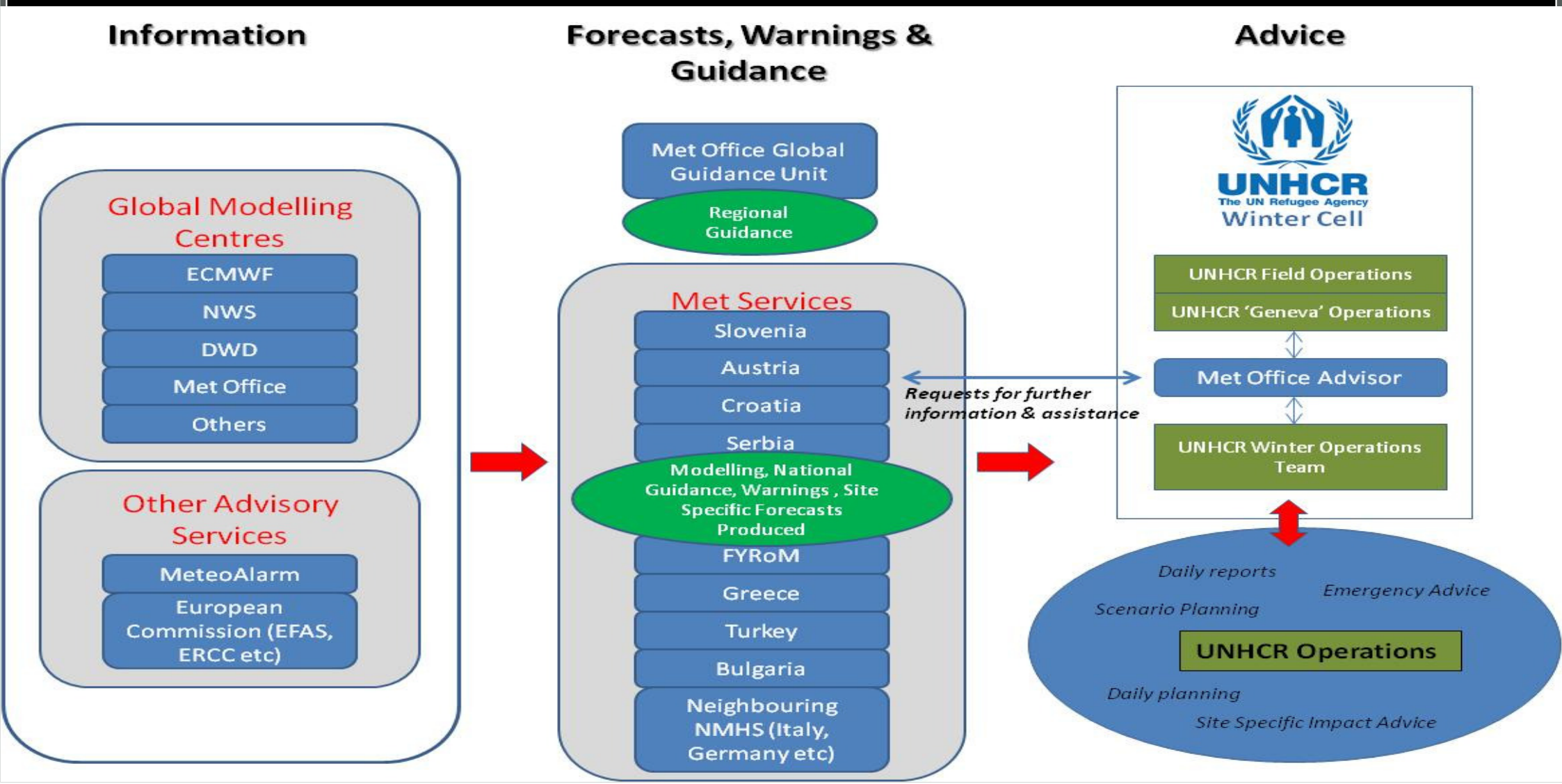
Example of collaboration:
UNHCR activity in South East Europe
(WMO, UKMO, SEE NMHSs)



www.metoffice.gov.uk

UNHCR - The Winter Operations Cell

Work Flow - Overview



CONTRIBUTION OF SOUTH EAST EUROPE NMHS TO

ORT TO

CONTRIBUTION OF SOUTH EAST EUROPE NMHS TO WMO-UK MET OFFICE COORDINATION OF MET SUPPORT TO UNHCR DURING THE REFUGEE CRISIS IN EUROPE

- **NMHS 24/7 Offices**: Turkey, Greece, former Yugoslav Republic of Macedonia, Serbia, Croatia, Slovenia
- **Coordination:** WMO Secretariat and UK Met Office
- **UNHCR Winter Cell:** UK Met Office forecasters preparing jointly with shift forecasters from SEE the daily reports for identified spots on route of refugees of particular concern of UNHCR
- **Video Conferencing:** Blue Jeans – e.g. 18+ participants becoming regular activity

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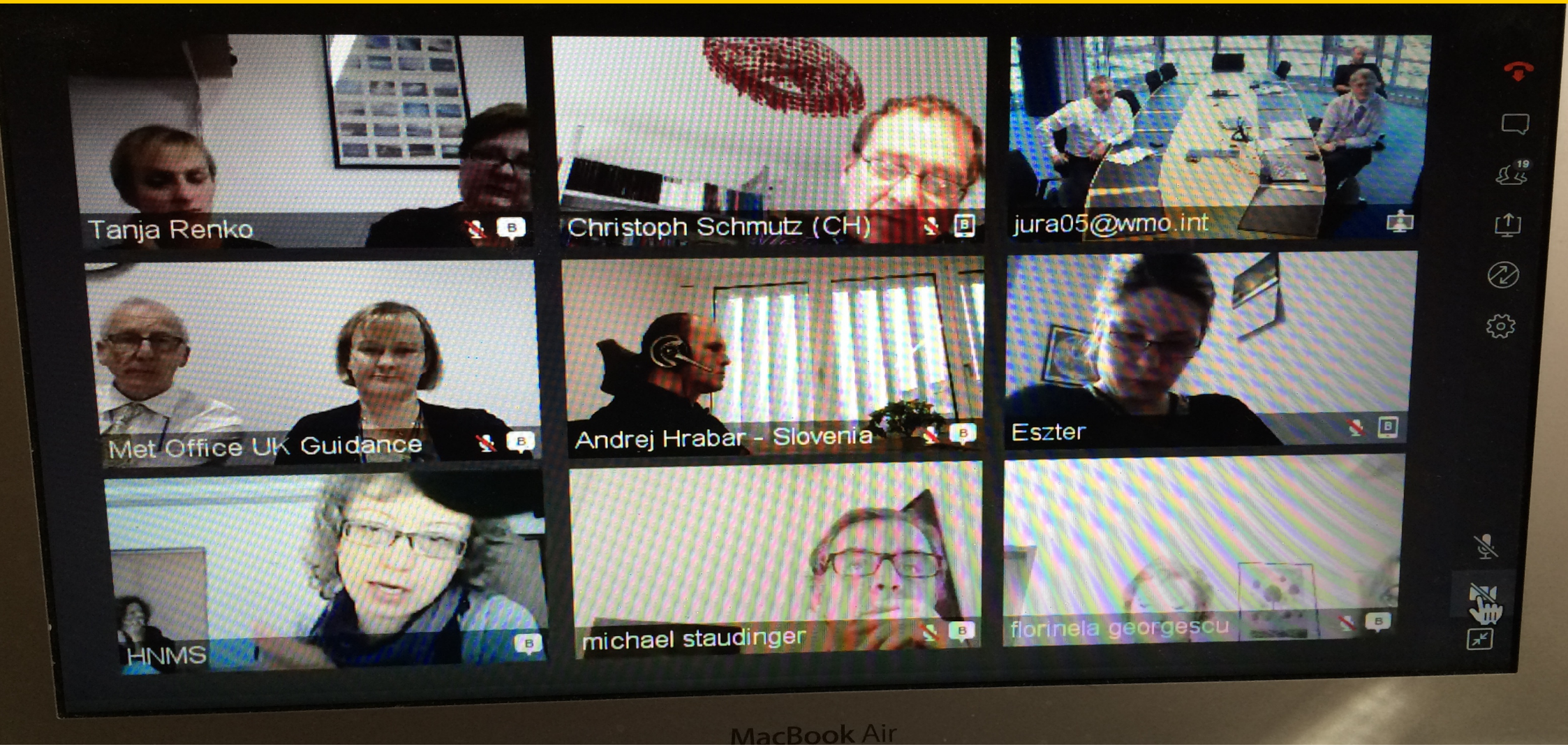

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CONCLUSIONS

- **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

In most of the Beneficiaries of the 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

- 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

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

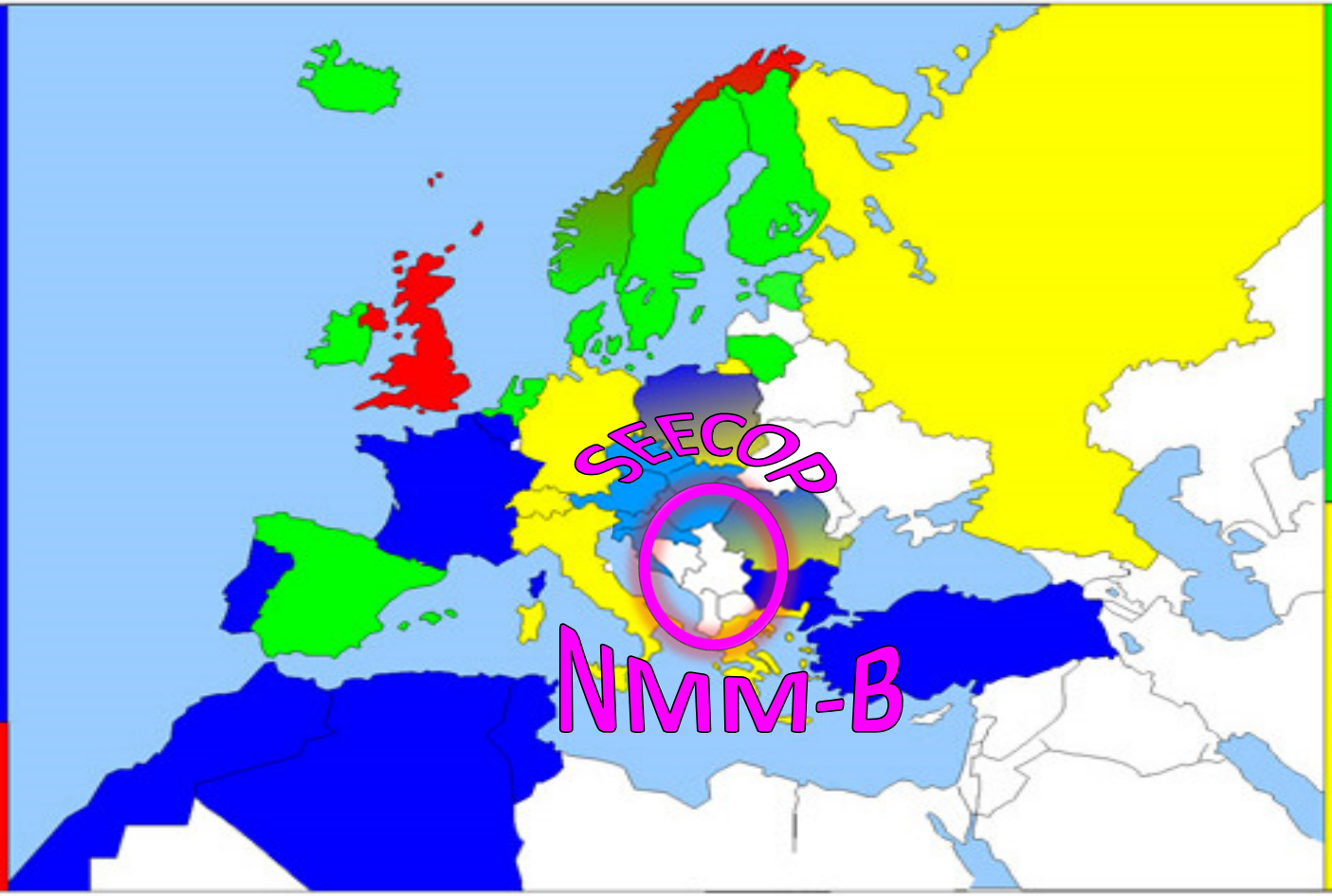
- **Cooperation is necessary:** Knowing that governments are confronted with serious budget cuts, affecting severely the human resources and infrastructural developments, Informal Conference of SEE NMHS Directors (ICSEED) concluded that collaborative efforts in SEE should be explored as an important 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

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
LACE

UKMO
United Kingdom
Norway

HIRLAM
Denmark
Estonia
Finland
Iceland
Ireland
Lithuania
Netherlands
Norway
Spain
Sweden

COSMO
Germany
Greece
Italy
Poland
Romania
Russia
Switzerland

SOUTH EAST EUROPE MEMBERS TO ECMWF

ECMWF has 22 Member States and 12 Co-operating S

Member States

Austria, Belgium, **Croatia**, Denmark, Finland, Fr rma reece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norw , Portugal, S , Slov a, Spain, Sweden, Switzerland, **Turkey** and the United Kingdo

(five member states from SEE)

Co-operating States

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

(five co-operating states from SEE)

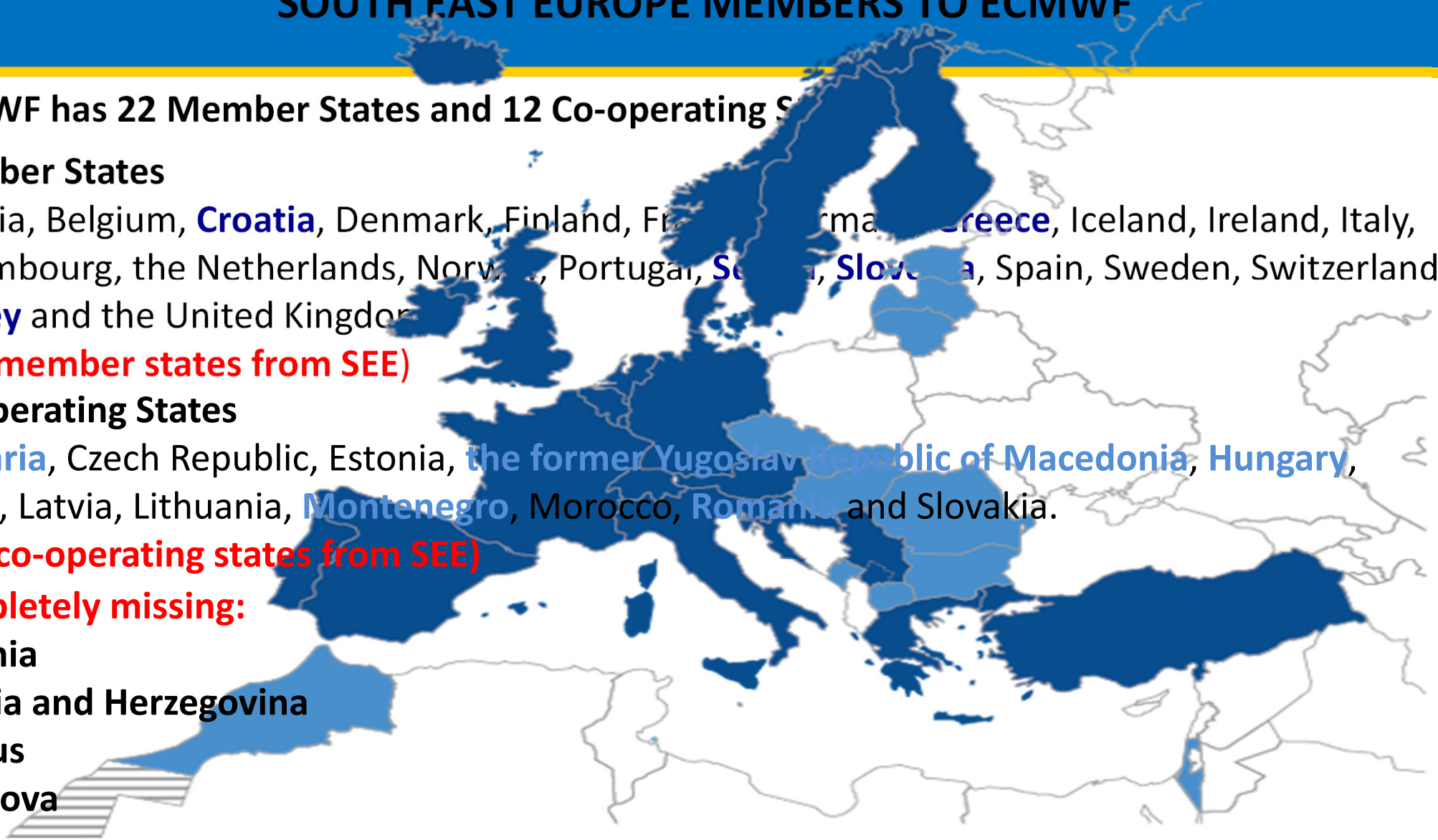
Completely missing:

Albania

Bosnia and Herzegovina

Cyprus

Moldova



WAY AHEAD

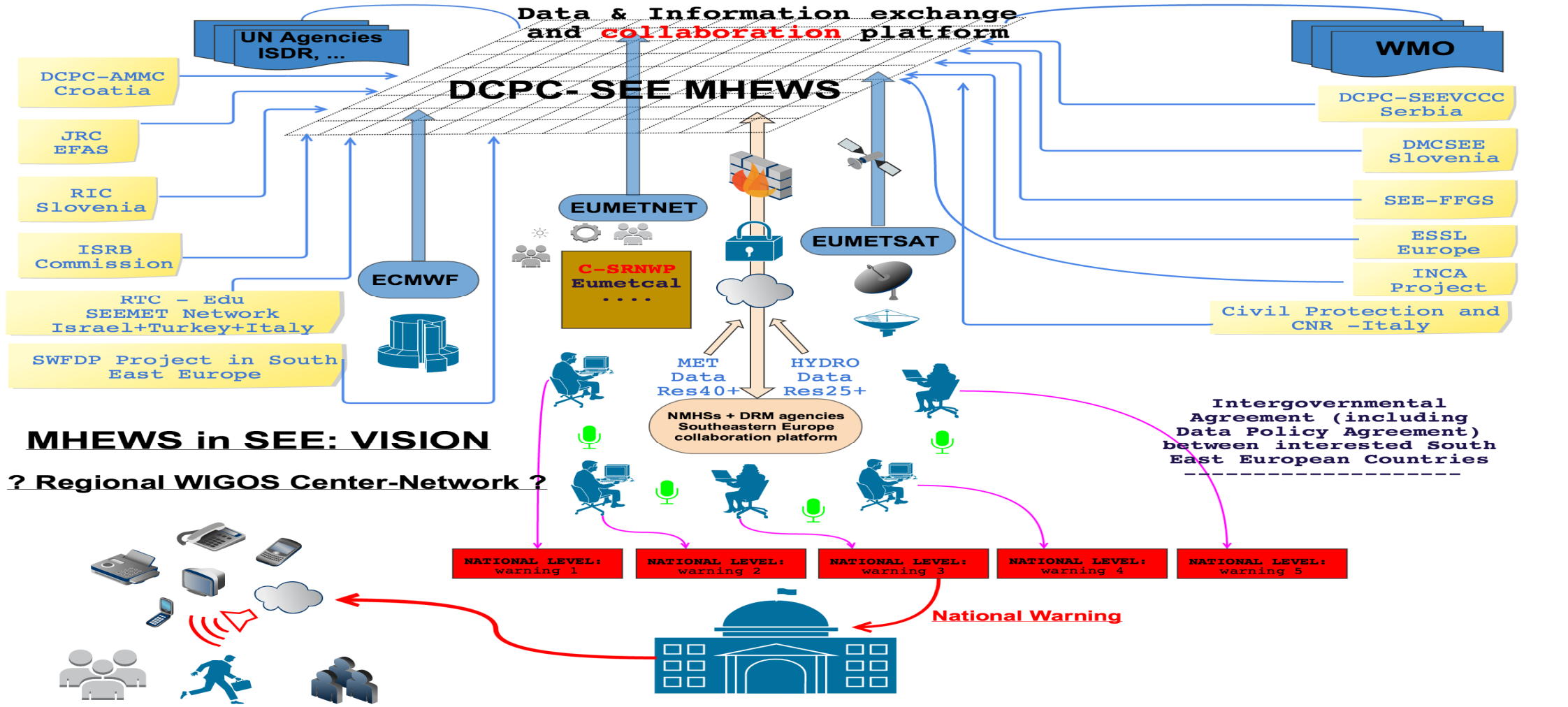
- **Sustain** and **continue**, *keep momentum* and build on achievements
- Keep **focus** on major **hazards**
- *Streamline* and *leverage development actions* to ensure **interoperability** and **seamlessness** by the *WMO guidance* and *assistance*
- Address the **technological gaps** of the hydro-meteorological *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 trough 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 ?

SEE-MHEWS-A
Implementation Plan

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

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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 1st 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

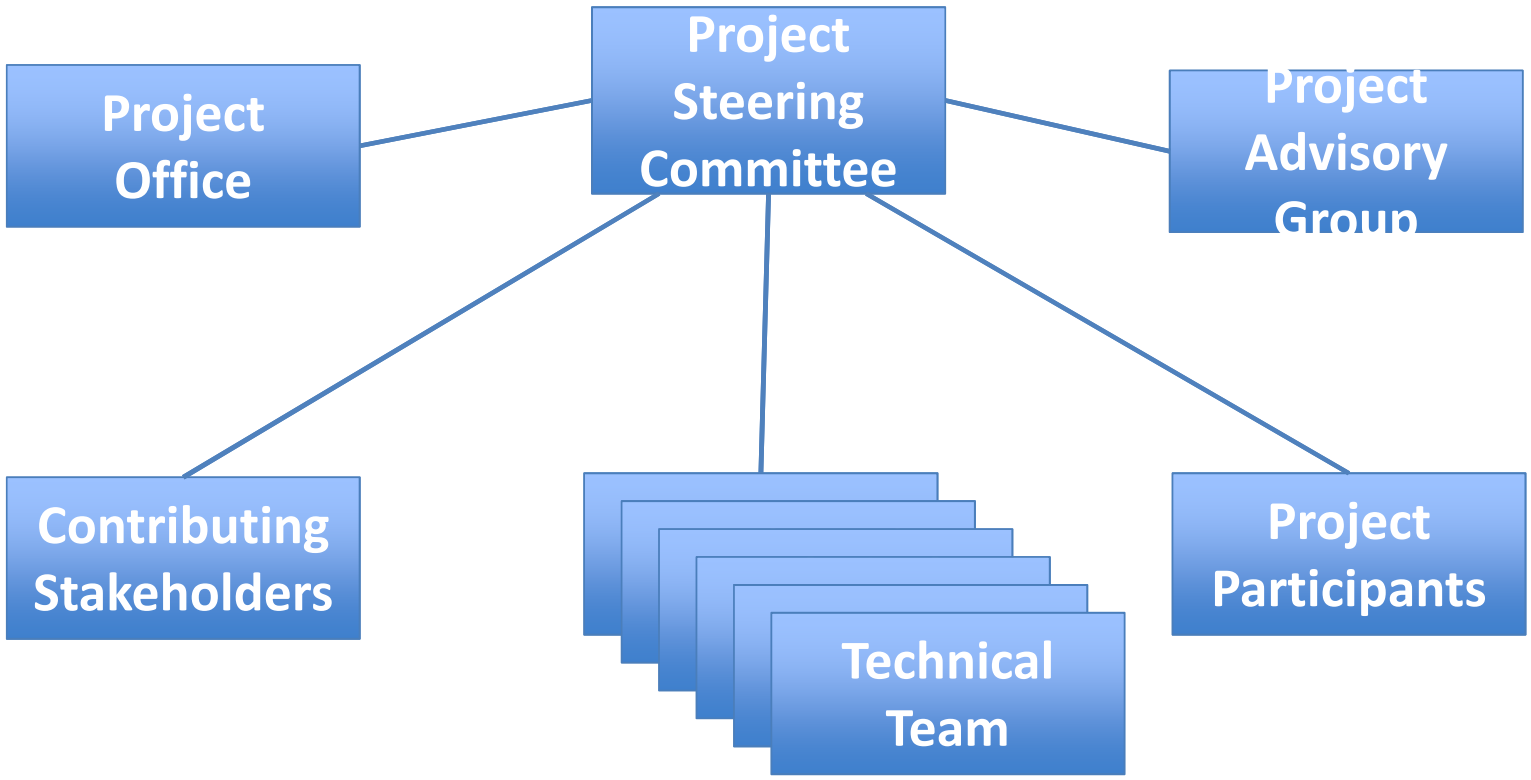
1. **Purpose of this Document**
2. **Introduction**
   - Rationale for SEE-MHEWS-A
   - Objectives
   - Major Hazards
   - Project Management Overview
   - Description of Implementation
3. **Key Activities for SEE-MHWES-A Implementation**
   - Management of SEE-MHEWS-A Implementation
   - Sub-Regional 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

DESCRIPTION OF IMPLEMENTATION

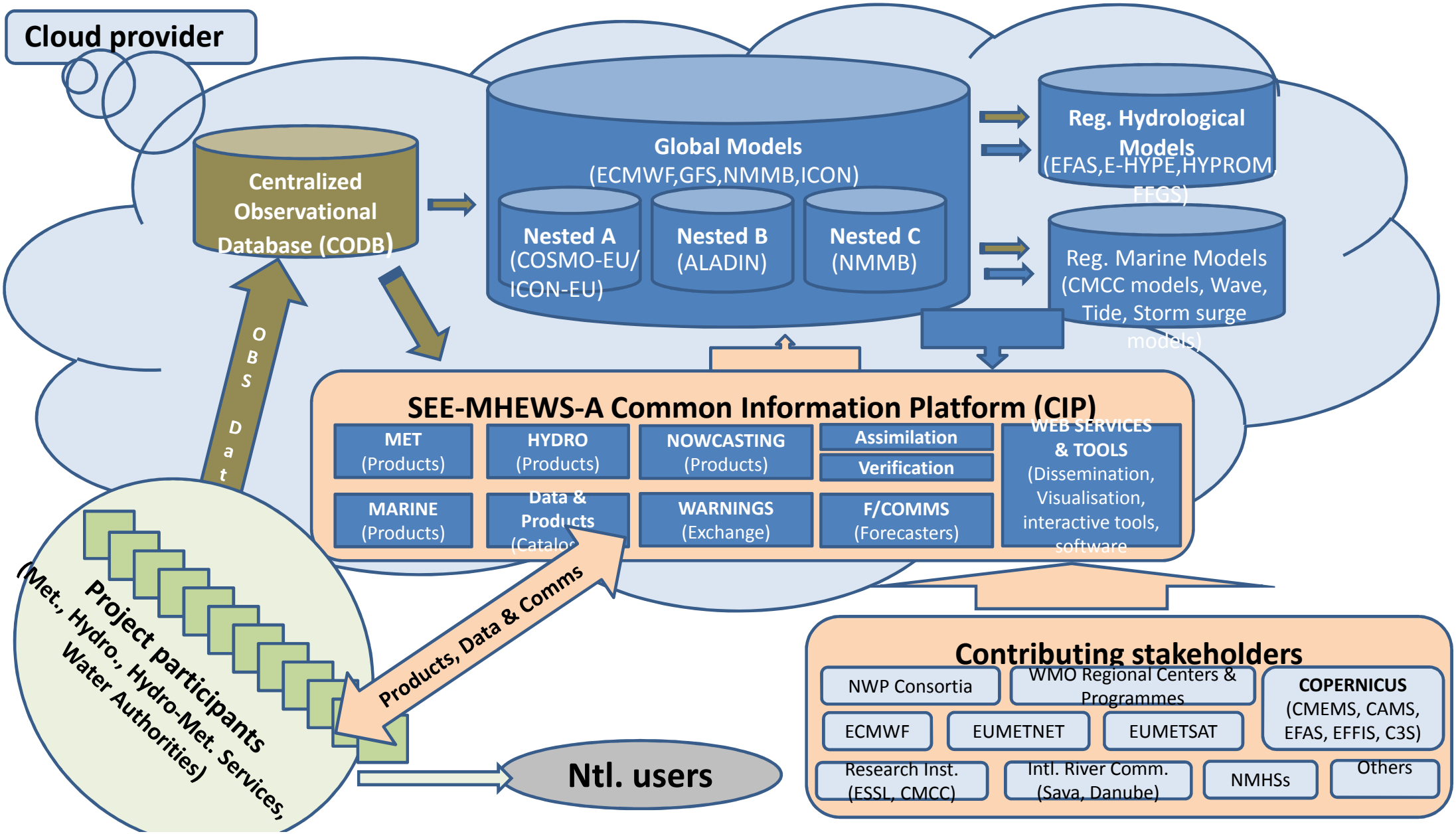
- **Development** Phase (mid-2016 to mid-2017)
- **Resource** Mobilization Phase (mid-2017 to end-2017)
- **Implementation** Phase (2018 - 2022)
- **Testing** Phase (January - June 2023)
- **Operational** Phase (mid-2023 onwards)

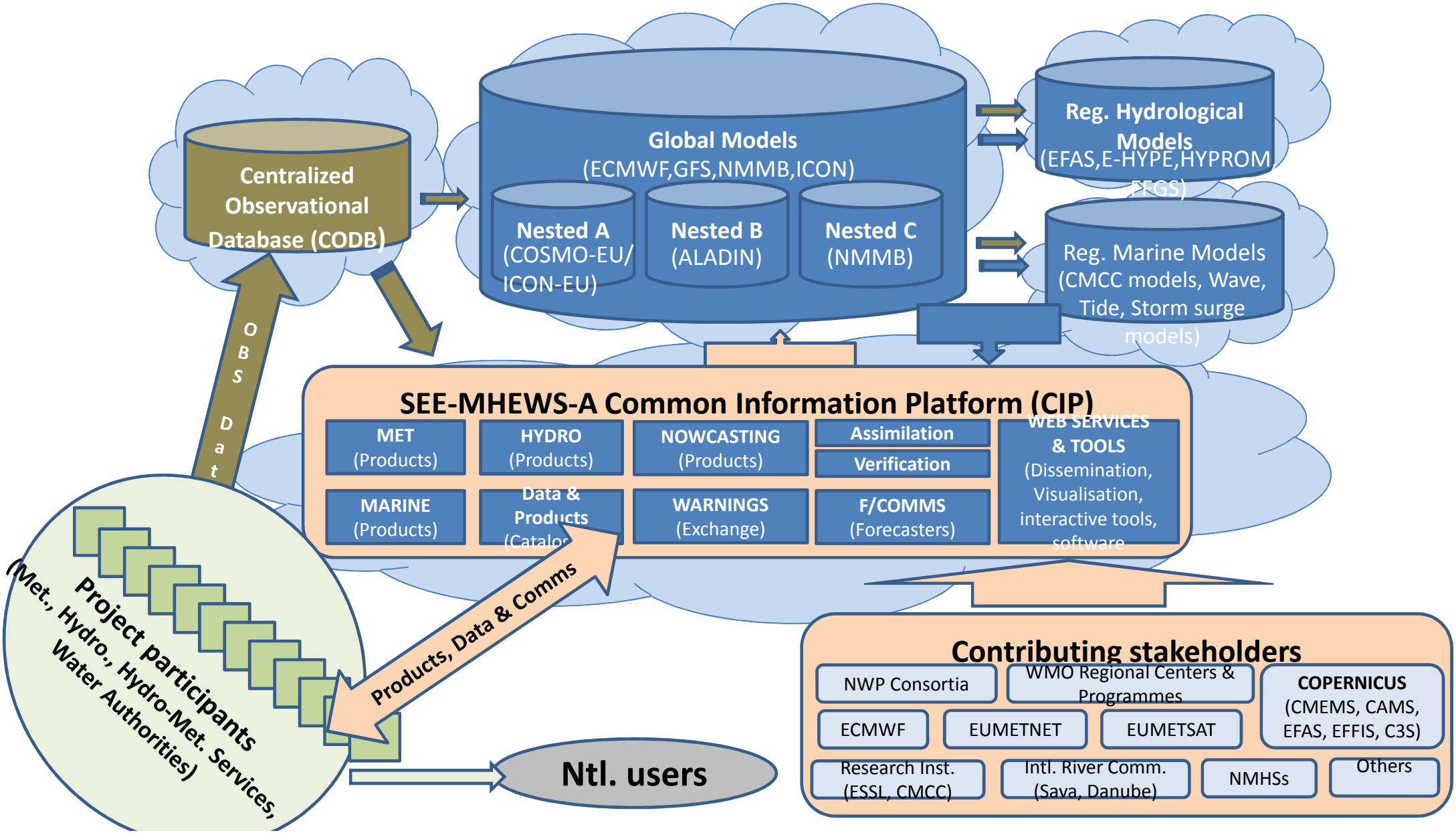
PROJECT MANAGEMENT STRUCTURE



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 includs 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


Cloud provider
Centralized Observational Database (CODB)
Global Models (ECMWF,GFS,NMMB,ICON)
Nested A (COSMO-EU/ ICON-EU)
Nested B (ALADIN)
Nested C (NMMB)
Reg. Hydrological Models (EFAS,E-HYPE,HYPROM FFGS)
Reg. Marine Models (CMCC models, Wave, Tide, Storm surge models)
OBS Data
SEE-MHEWS-A Common Information Platform (CIP)
MET (Products)
HYDRO (Products)
NOWCASTING (Products)
Assimilation
Verification
WEB SERVICES & TOOLS (Dissemination, Visualisation, interactive tools, software
MARINE (Products)
Data & Products (Catalo
WARNINGS (Exchange)
F/COMMS (Forecasters)
Project participants (Met., Hydro., Hydro-Met. Services, Water Authorities)
Products, Data & Comms
Ntl. users
Contributing stakeholders
NWP Consortia
WMO Regional Centers & Programmes
COPERNICUS (CMEMS, CAMS, EFAS, EFFIS, C3S)
ECMWF
EUMETNET
EUMETSAT
Research Inst. (ESSL, CMCC)
Intl. River Comm. (Sava, Danube)
NMHSs
Others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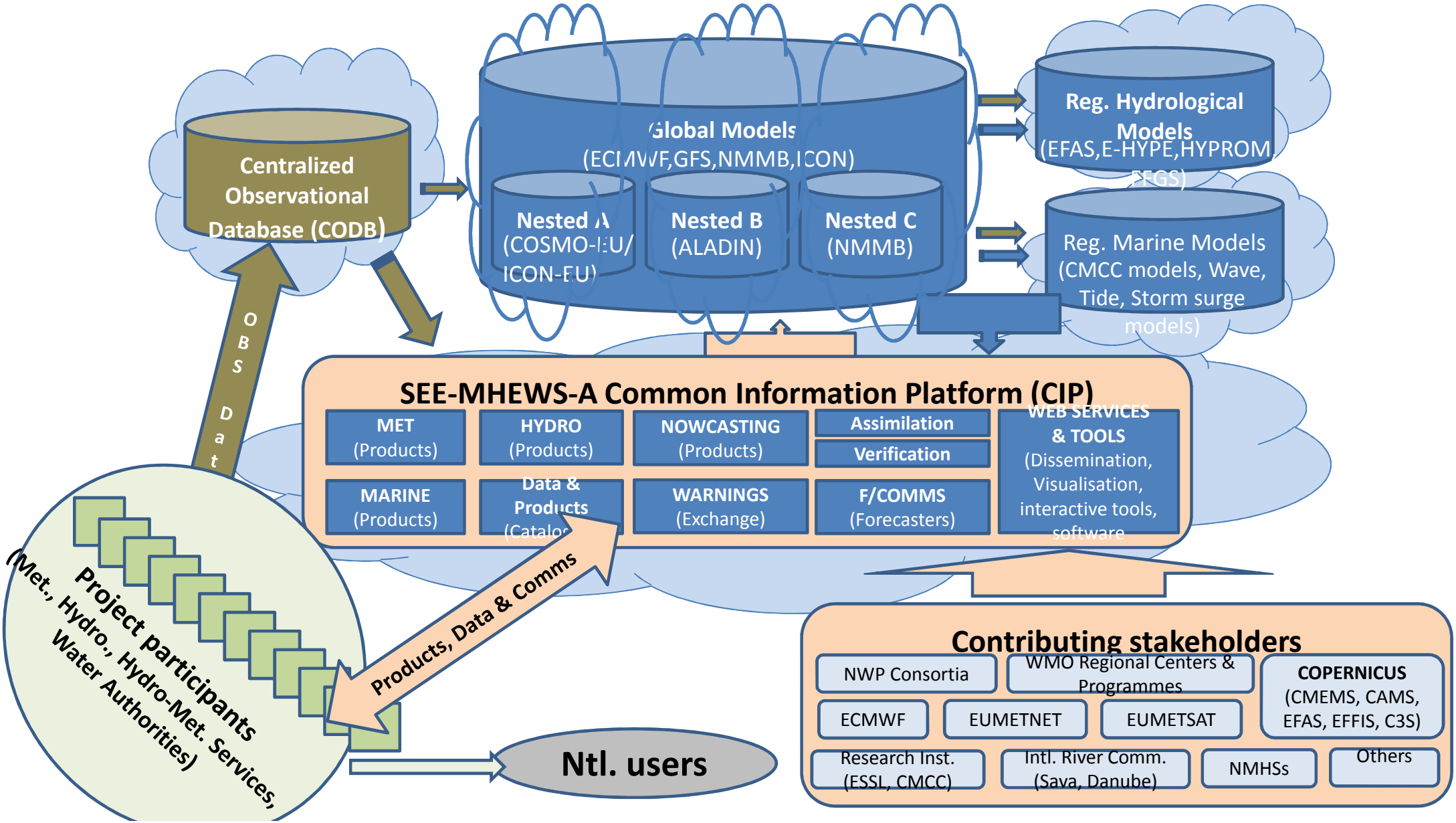
(Sava, Danube)
NMHSs
Others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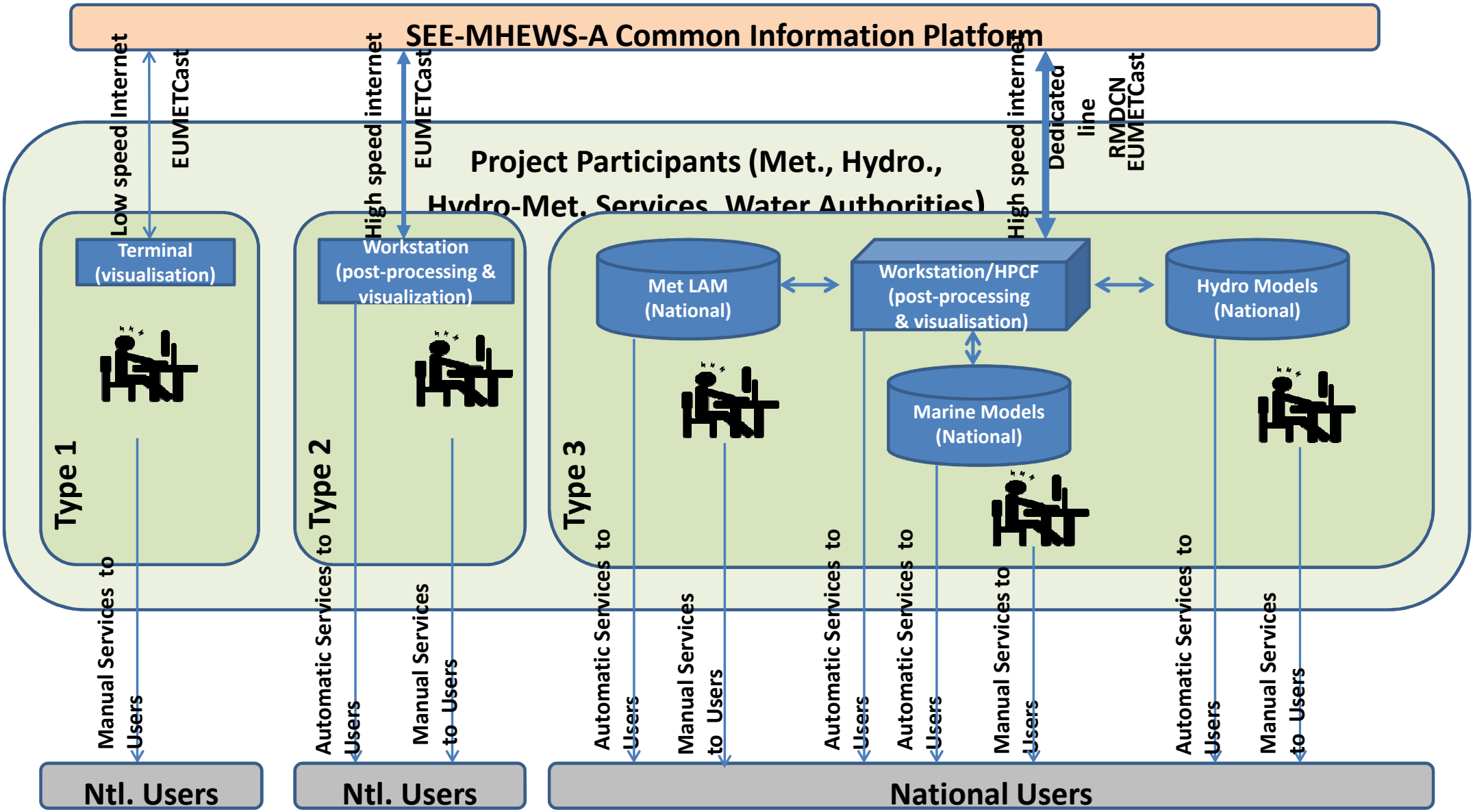
Others


SEE-MHEWS-A Common Information Platform
Low speed Internet
EUMETCast
High speed internet
EUMETCast
High speed internet
Dedicated line
RMDCN
EUMETCast
Project Participants (Met., Hydro., Hydro-Met. Services, Water Authorities)
Terminal (visualisation)
Workstation (post-processing & visualization)
Met LAM (National)
Workstation/HPCF (post-processing & visualisation)
Hydro Models (National)
Marine Models (National)
Type 1
Type 2
Type 3
Manual Services to Users
Automatic Services to Users
Manual Services to Users
Automatic Services to Users
Manual Services to Users
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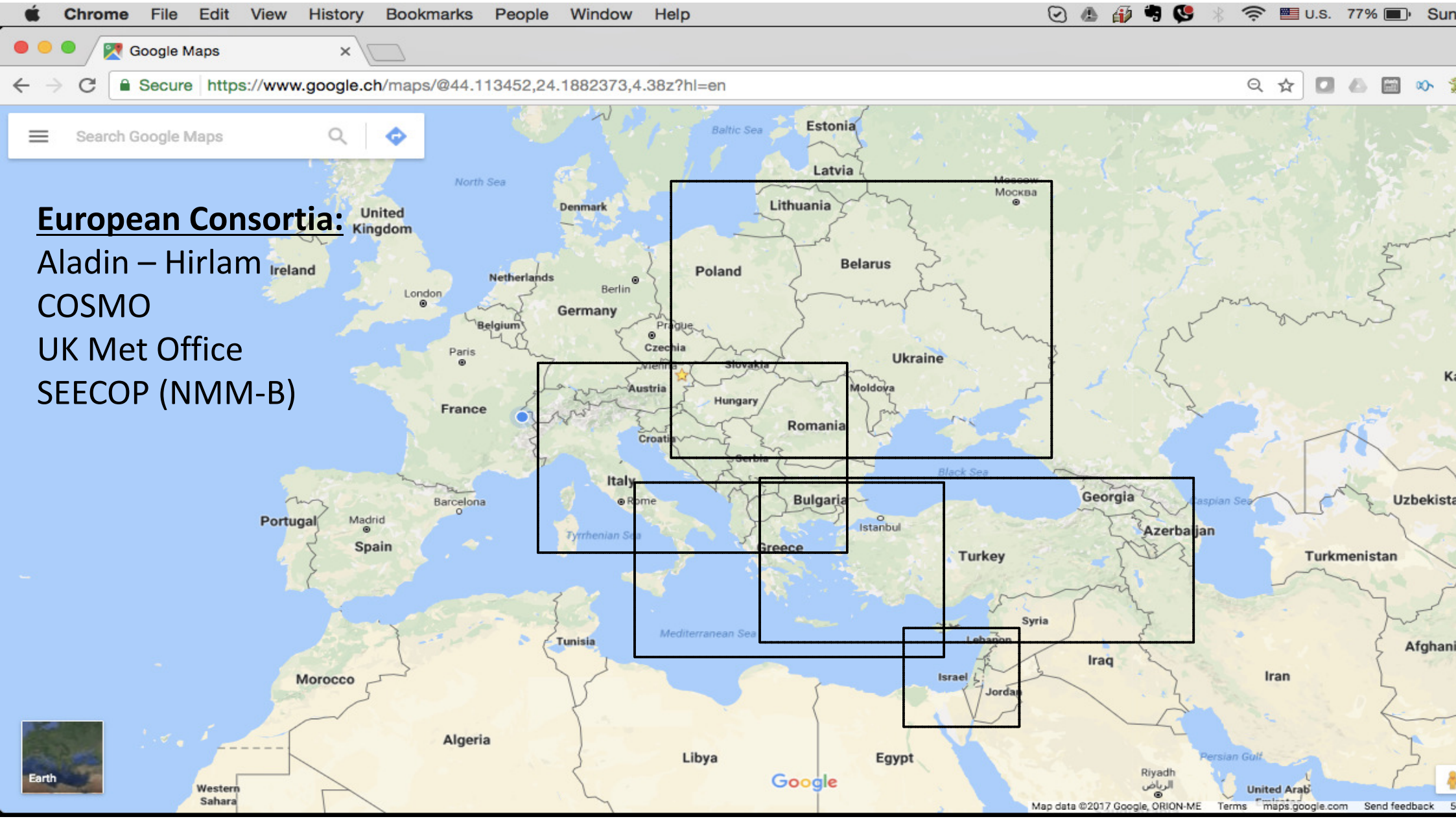
Ntl. Users
Ntl. Users
National Users


Chrome File Edit View History Bookmarks People Window Help
Google Maps
Secure https://www.google.ch/maps/@44.113452,24.1882373,4.38z?hl=en
Search Google Maps
European Consortia:
Aladin – Hirlam
COSMO
UK Met Office
SEECOP (NMM-B)
Baltic Sea
Estonia
Latvia
Lithuania
Moscow
Москва
North Sea
Denmark
United Kingdom
Ireland
Netherlands
Berlin
Poland
Belarus
London
Germany
Belgium
Prague
Czechia
Paris
Ukraine
Slovakia
Austria
Moldova
Hungary
France
Romania
Croatia
Serbia
Black Sea
Italy
Rome
Bulgaria
Georgia
Barcelona
Portugal
Madrid
Spain
Tyrrhenian Sea
Istanbul
Azerbaijan
Uzbekista
Greece
Turkey
Turkmenistan
Syria
Mediterranean Sea
Tunisia
Lebanon
Afghani
Iraq
Morocco
Israel
Iran
Jordan
Algeria
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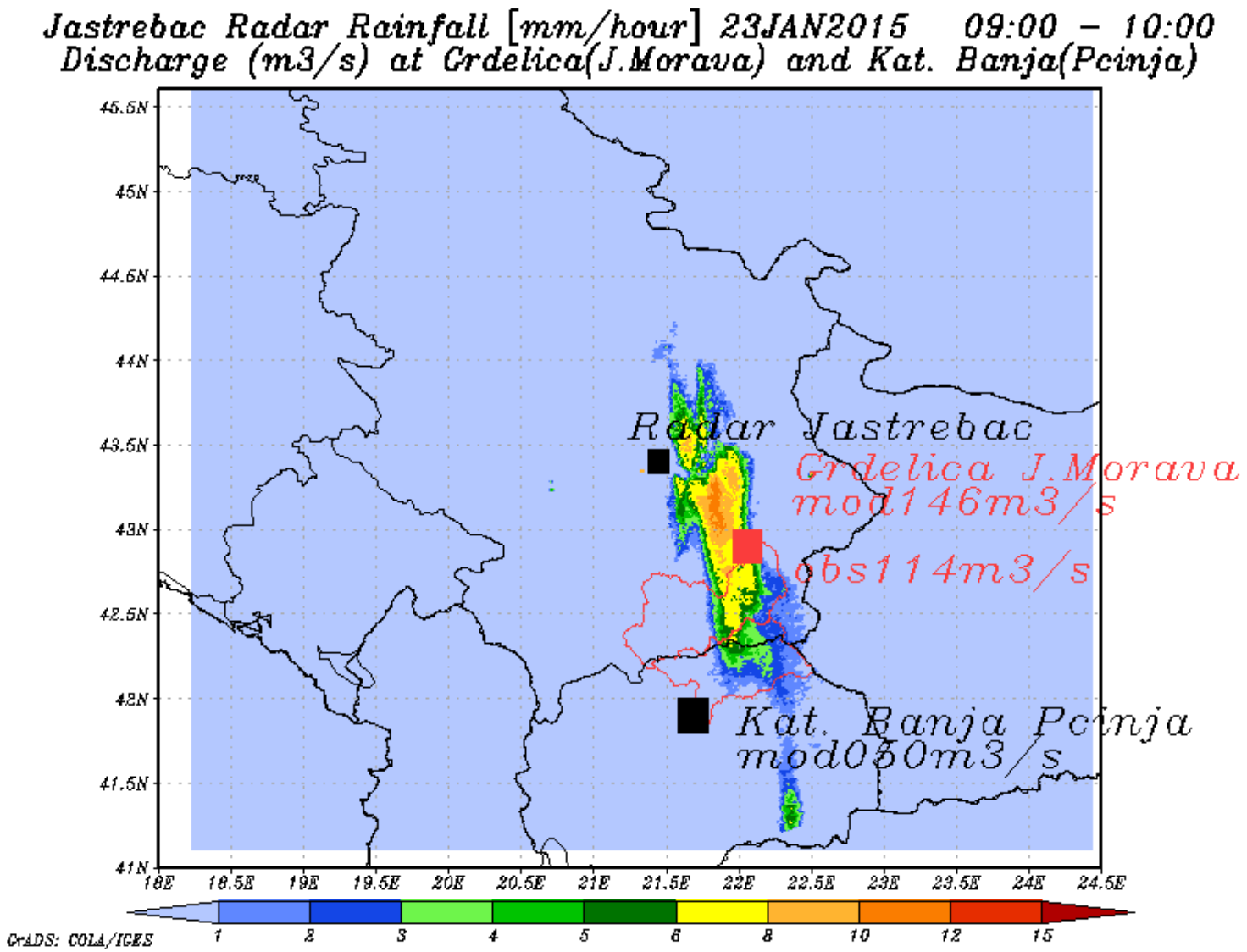
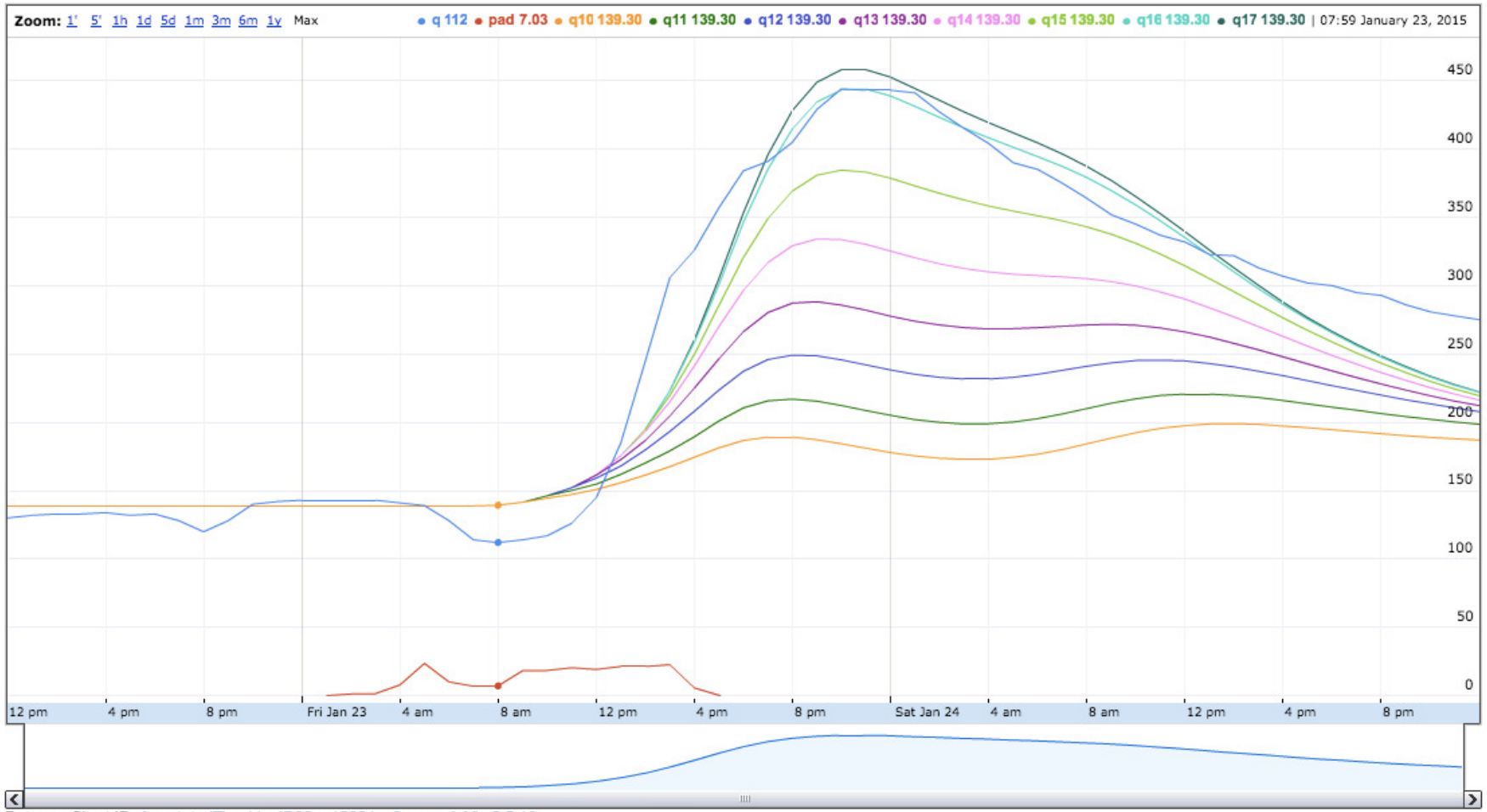

Jastrebac Radar Rainfall [mm/hour] 23JAN2015 09:00 – 10:00
Discharge (m3/s) at Grdelica(J.Morava) and Kat. Banja(Pcinja)
Radar Jastrebac
Grdelica J.Morava
mod146m3/s
obs114m3/s
Kat. Banja Pcinja
mod050m3/s
45.5N
45N
44.5N
44N
43.5N
43N
42.5N
42N
41.5N
41N
18E
18.5E
19E
19.5E
20E
20.5E
21E
21.5E
22E
22.5E
23E
23.5E
24E
24.5E
1
2
3
4
5
6
8
10
12
15
GrADS: COLA/ICES

Grelica River discharge



Data: x • Chart ID: AnnotatedTimeLineID30ea12964ca0 • googleVis-0.5.10
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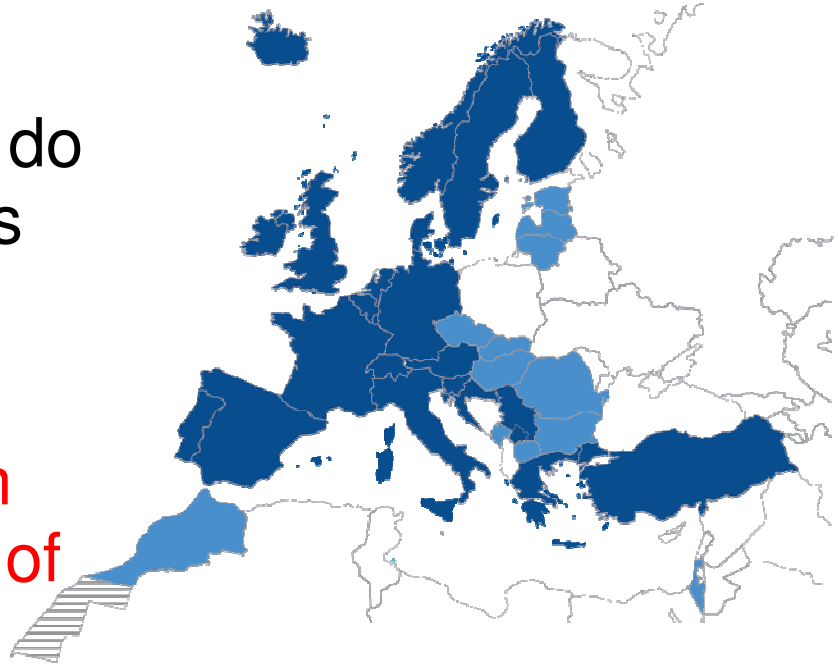
NEXT STEPS FOR SEE-MHEWS-A PROJECT

- 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.

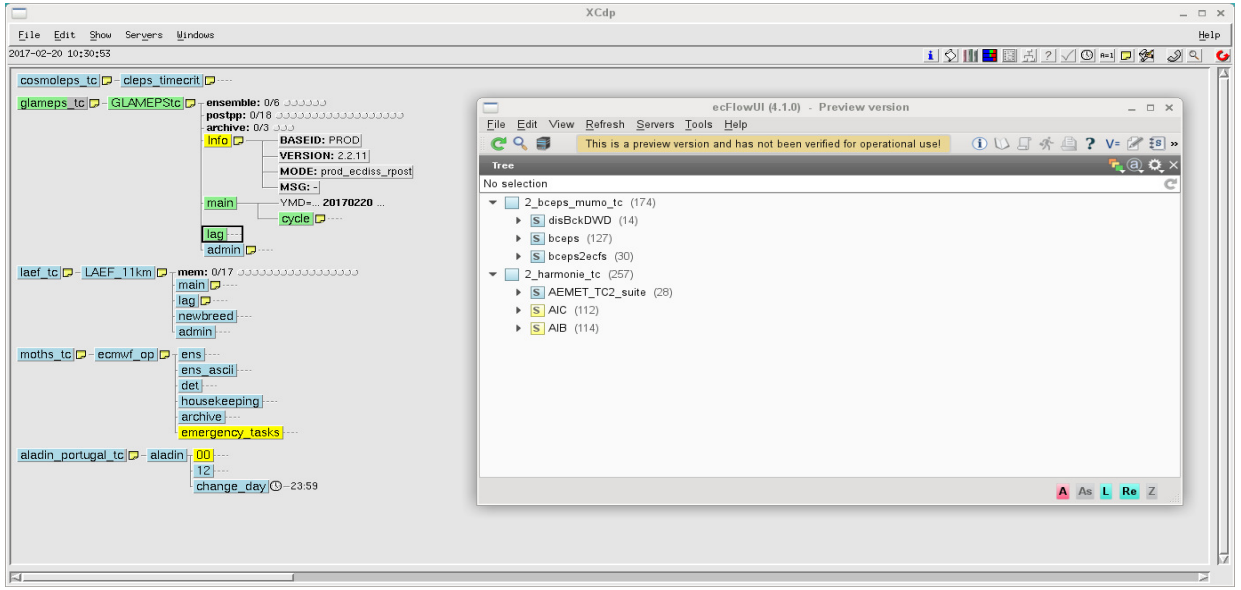


Member States «operational» activities at ECMWF.

- 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
  - ✓ **28th 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 succesfully **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, Sl

Summary: International Collaboration?

- Joint effort from 5 countries full-members of ECMWF 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)

WEATHER CLIMATE WATER

Thank you

(mdacic@wmo.int)

WORLD METEOROLOGICAL ORGANIZATION