World Meteorological Organization

REGIONAL ASSOCIATION VI

FINAL REPORT OF

RA VI WORKING GROUP ON CLIMATE AND HYDROLOGY (WG-CH)

2017

REFERENCES:

1. Abridged Final Report with Resolutions of the Fifteenth session of the Regional Association VI (Europe) (WMO-No. 1046)
2. Reports of the RA VI Task Teams (references provided in the appendices below)

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1. Introduction

1.1 The Working Group on Climate and Hydrology (WG-CH) has been re-established by the XVI Session of RA-VI, in Helsinki, September 2013, through its Resolution 10 RA VI-16). The new structure of the Group with flexible Task Teams was aligned with WMO and RA VI strategies, and was conceived to allow stronger interaction between different disciplines and activities with the view to leverage resources for greater societal benefits.

1.2 The WG-CH has proven to be more effective in this second intersessional period, as its terms of references and goals were designed already in an integrated way, nevertheless improvements are still needed concerning both the terms of reference and the operating way of the group. As it concern its terms of reference while recognizing the existence of several activity domain in which climatology and hydrology can mutually contribute to the work, there are still some activities that belong to only one of the two disciplines and nevertheless are of paramount importance for the Members (e.g. hydrological network design, or climate data quality control). Concerning the way it operates, there is need accelerate the process to identify and nominate national experts and ensure their continuous involvement in the group's work and better address the gender and regional balance.

Following the experience from the past two intersessional periods (2009-2012 and 2013-2017), the proposed updated structure and work programme of the Working Group for 2018-2021 implies a higher level of participation and interaction.

2. Composition

The WG-CH was composed of 11 core-members, including one co-chair for Climate, one co-chair for Hydrology and leaders for six task teams (see Annex 1).

3. Main events and outcomes/deliverables.

The WG-CH held frequent teleconferences and two face-to-face meetings during the reporting period. Also the Working Group organised and co-organised several events (see Annex 2).

A concise summary of the main outcomes from different task teams is also compiled in Annex 2. In addition to this summary, a longer report of outcomes and deliverables from each task team is included in Annexes 3-8. Both the summary and longer reports include hyperlinks with complementary information.

The three hydrology fora organized in 2012, 2014 and 2016 has provided a unique opportunity for gathering representative of a large number of NHSs for the region to discuss their common problems priorities. Outcomes of the hydrology forum have fed into the design of the work plan of the Regional Association and especially of the WG-CH. A particularly beneficial role of the forum's meetings has been to foster the participation of representative f countries that previous had rarely or never been involved in regional or WMO HWRP activities.

One very important achievement of was the RCC meeting held in Belgrade (October 2016) with the overall objective of revisiting the role, objectives and governance (and Implementation Plan) of the RCC-network in the light of the landscape evolution.

4. Recommendations for the next intersession period

Taking account of the proposals of the RA VI WG-CH Task Team members, the WG-CH recommends for the next intersession period (see Annex 9 for the preambulatory clauses and detailed explanation of recommendations):

(a) WG activities will cluster around two poles (Hydrology and Climatology) and each Task Team will have a composition reflecting the proportional relevance, contribution and interest of each of the two domains. The Clusters will address specific climate, respective specific hydrological activities of the region, as recognizing the differences between climatological and hydrological activities with regard to time and space scales, and methodologies. The new proposed structure is seeking a better alignment and connectivity with the activities of the Technical Commissions (Commission for Climatology and Commission for Hydrology). The link between the two Clusters will be through Joint activities on implementation of Climate Services (see Figure 1 and Annex 10)

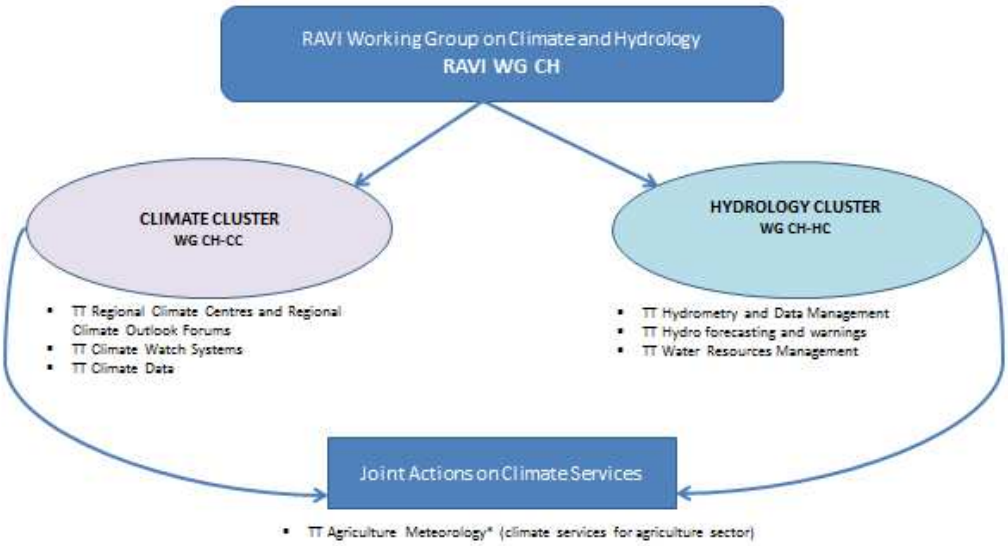

Figure 1.- Structure of the proposed RAVI Working Group on Climate and Hydrology including two clusters on Climate and Hydrology and Joint Actions on Climate Services

The WG CH major contributions focus on the expected results, as follows:

ER1: Enhanced capabilities of Members to deliver and improve access to high quality weather, climate and water and related environmental predictions, information and services in response to users' needs and to enable their use in decision-making by all relevant societal sectors
ER2: Enhanced capabilities of Members to reduce risks and potential impacts of hazards caused by weather, climate and water and related environmental elements,
ER3: Enhanced capabilities of Members to produce better weather, climate, water and related environmental information, prediction and warnings to support in particular climate impact and adaptation strategies

ER6: Enhanced capabilities of NMHSs, in particular in developing and least developed countries, to fulfil their mandates

(b) With the view to facilitate the implementation of the above listed tasks, to compose the Working Group of:
- a co-chairperson on Climate, coordinating the specific activities of the Climate Cluster and facilitate the connectivity with the Hydrology Cluster and the Joint Actions on Climate Services;
- a co-chairperson on Hydrology, coordinating the specific activities of the Hydrology Cluster and facilitate the connectivity with the Climate Cluster and the Joint Actions on Climate Services;
- Task Team leaders;
- Rapporteurs, and
- Other volunteer experts, as necessary.

(c) The activities, relevant task teams and their leaders should be identified ideally already during the session, on the basis of nomination solicited from Member in response to the proposed topics identified in this report. This in order to minimize the lag time between the session and the real beginning of the WG activities.

(d) With the view to optimize the creation of different Task Teams, to make the needed arrangements in order to identify and nominate experts using a quick and efficient procedure aiming to recruit the actual experts in their respective fields for the different Task Teams.

(e) To limit the Task Teams' Terms of Reference to a few well-defined and reachable objectives consistent with the resources and time commitment available. Objectives should ideally be linked to concrete deliverables.

(f) To take due note of the specific recommendations from different Task Teams listed in the corresponding reports summarized in Annexes 3-8.

5. Acknowledgments.

5.1 The Co-chairs of the WG would like to express their appreciation and gratitude to all experts who have contributed to the work of the Group.

5.2 Particular thanks are due to the core-members, all active Task Team members, and WMO Secretariat: Regional Office for Europe and Climate and Water Department.

2.- Composition of the Working Group on Climate and Hydrology

The Working Group was composed of 11 core-members, including one co-chair for Climate, one co-chair for Hydrology and leaders for six task teams, as follows:

Vladimir Kryjov (Rusia) (until Dec 2014) / Ernesto Rodriguez Camino (Spain) (from Dec 2014)	Co-chair for Climate
Dominique Berod (Switzerland) (until May 2016) / Cristina Alionte Eklund (Sweden) (from May 2016)	Co-chair for Hydrology
J.-P.Ceron (France)	Leader Task Team on Regional Climate Centres and Regional Climate Outlook Fora
Ernesto Rodriguez Camino (Spain) (until Dec 2014) / Hermann Mächel (Germany) (from Dec 2014)	Leader Task Team on Climate Watch System
Josef Eitzinger (Austria)	Leader Task Team on Agriculture Meteorology
Silvano Pecora (Italy) & Sandor Szalai (Hungary)	Co-leaders Task Team on Water Scarcity and Drought
Cristina Alionte Eklund (Sweden) (until May 2016) / Eric Sprokkereef (Netherlands) (from May 2016)	Leader Task Team on Hydrological Modelling, Forecasting and Warnings
Jose Antonio Guijarro (Spain) & Harry Dixon (UK)	Co-leaders Task Team on Data Operations and Management

3.- Main events and outcomes/deliverables.

3.1.- Main events

The Working Group on Climate and Hydrology (WG/CH) held frequent teleconferences and two face-to-face meetings during the reporting period:

- WG/CH/1: Warsaw, Poland, 23 September 2014
- WG/CH/2: Oslo, Norway, 19 September 2016

Teleconferences were arranged and supported by the WMO Secretariat.

The Working Group organised and co-organised several events, as follows:

- RAVI Hydrology Forum, 24-26 September 2014, Warsaw, Poland
- RAVI Workshop on hydrological modelling, forecasting and warnings (back-to-back with Hydrology Forum), 20 September 2016, Oslo, Norway
- RAVI Hydrology Forum, 21-23 September 2016, Oslo, Norway
- RA VI Workshop on RCC Implementation, 11-13 October 2016, Belgrade, Serbia

3.2.- Summary of main outcomes and deliverables listed by Task Team

- **The Task Team on Regional Climate Centres and Regional Climate Outlook Fora** (Annex 3) coordinated all RCC and RCOF activities in WMO RA VI in close liaison with CCl works and developments. The TT included, among other issues: i) standardization of products and services, ii) impact of data sharing at regional level (see resolution 60), iii) increasing visibility of both RCC and RCOFs activities, iv) enhancing collaboration and synergy within RA VI but also with the neighboring RAs. To avoid any duplication, the TT focused on the contribution to CCl deliverables instead preparing its own deliverables as they are very relevant for both RCCs and RCOFs and should be available for the next CCl session (in March 2018). One very important achievement of the TT was the RCC meeting held in Belgrade (October 2016) with the overall objective of revisiting the role, objectives and governance (and Implementation Plan) of the RCC-network in the light of the landscape evolution.

- **The Task Team on Climate Watch System** (Annex 4) further developed and coordinated the production of Climate Watch Advisories for RA VI. The TT established a dedicated website for NMHSs of WMO RA VI (Europe) with protected access to present and past Climate Watch Advisories (http://rcccm.dwd.de/DWD-

RCCCM/EN/products/cwa/cwa_node.html). The TT also started to design the guidance document for Climate Watch Implementation intended to support NMHSs in the region with their operational implementation of national climate watch systems. Also outreach and awareness enhancement activities were conducted with a contribution to the WMO-Bulletin describing two showcases successfully forecasted by the Climate Watch System (WMO Bulletin 65, 28-31, available from https://library.wmo.int/pmb_ged/bulletin_65-1_en.pdf).

- **The Task Team Regional on Agriculture Meteorology** (Annex 5) has mainly contributed in the promotion, coordination and implementation of Agrometeorology related services and activities in RA VI. The TT has focused on the economic impacts of agrometeorological information in Europe and on tailoring agrometeorological services and products at local level, taking into account climate change impacts/adaptation on the whole agricultural production chain, including related training and education. The TT has also evaluated hydrological databases, products and services for agrometeorological issues (in coop. with hydro-meteorological task teams).

- **The Task Team on Water Scarcity and Drought** (Annex 6) has been involved in a mosaic of activities with many valuable results; however, a better information flow is needed. The activities of the TT included: i) preparations and participation in international conferences; ii) participation in different EU-projects and/or developing call proposals for different EU programs (e.g. FP7 project ENHANCE, Central Europe PROLINE-CE, Copernicus Climate Change Services C3S, INTERREG V program, etc.); iii) case studies on the implementation of the UN System for Environment Economic accounting of water (UN SEEA-Water) with applications on southern Europe. The TT was also involved in low flows measurement development, through implementing the Quality Management System for discharge measurements. Findings of the CHy survey on the status of QMS in NHSs were presented in the CHy-15 (Rome, Italy, 7-13 Dec 2016).

- **The Task Team on Hydrological Modelling, Forecasting and Warnings** (Annex 7) main achievement was the preparation and organization of the Regional Workshop on hydrological modelling, forecasting and warnings, held back-to-back with the 3-rd Hydrology Forum in September 2017, in Oslo. The workshop addressed the priorities areas of the region which were reflected into the three workshop sessions, respectively on Hydrological forecasting, warnings and communication with end-users, Remote sensing in Hydrology and Flash Floods and Urban Floods. All presentations are available on http://www.wmo.int/pages/prog/hwrp/RA6/hydroforum2016.php.The TT has followed up and, when possible coordinate with, other WMO and EC activities and programs, such as: EFAS (European Flood Awareness System, https://www.efas.eu/ ,which is part of the Copernicus Emergency Management Service); WMO FFGS, which is implemented in nine countries in south-east Europe; Working Group F (Flood) of the EC (European Commission). The TT has also compiled an overview document of ongoing and planned projects and activities in RAVI focused on transboundary hydrological cooperation in the river basins of the Rhine, Moselle/Saar, Sava and Danube.

- **The Task Team on Data Operations and Management** (Annex 8) adapted the TT-DARE website developed in the former inter-session period to reflect the new WG (http://www.climatol.eu/tt-dom/index.html), including new hydrological contents and information on the use of proxy data. The TT promoted open data policies (including publishing a MeteoWorld article outlining the recent Israel Meteorological Service experience, see: https://public.wmo.int/en/resources/meteoworld/case-study-free-data-access-%E2%80%93-experience-of-israel-meteorological-service). Over the intersessional period, the TT has maintained liaison with other key initiatives on data management and

standardization within the Region and globally. This included, TT members participating in the joint OGC/WMO development of water data standards such as WaterML2.0 and a WIGOS metadata profile (as part of the Hydrology Domain Working Group http://external.opengis.org/twiki_public/HydrologyDWG/WebHome). Engagement in this work during the development phase ensures that RA VI Members are in a stronger position to adopt these new standards into operational practice. With respect to the support of data sharing, TT members and other external collaborators came together in 2016 to submit a join proposal to a European Commission tender call from the ECMWF related to the collection and processing of in-situ observations.

ANNEX 3

WMO RA VI WG-CH

TASK TEAM REGIONAL CLIMATE CENTRES AND REGIONAL CLIMATE OUTLOOK FORUM

PROGRESS REPORT 2014-2017

Submitted by J.-P. Ceron

1. Main area of responsibility and ToRs

The main areas of responsibility are RCCs and Climate Outlook Forums within RA VI and including cross regional issues (especially with RA II and RA I).

The Terms of Reference were proposed at the last RA VI session as follow:

- Provide overall guidance, assistance and support in the implementation of the GFCS in RA VI
- Seek cooperation with relevant regional bodies and organizations on issues related to implementing user-oriented climate and hydrology services for key sectors, as well as DRR,
- Foster & promote best practices in establishing and implementing the GFCS at national level
- Promote enhanced utilization and broadening of WMO RCC Network products and services, particularly in support of national GFCS implementation, (updated analysis of user requirements and feedbacks, products offered at the GPCs' level).
- Improve the link between the RCCs and RCOFs and to assist in sustaining and strengthening the RCOF mechanism in RA VI and the inter-regional COFs,
- Develop methods and mechanisms to analyze requirements and feedback on effectiveness, gaps and improvement of RCOF and RCC services,
- Include downscaled LRF products in RCOFs practice and provide training on downscaling technologies to NMHSs
- Provide assistance in strengthening RCOF mechanisms in RA VI considering (i) inclusion of hydrological and agrometeorological information and users as well as (ii) implementation of Climate Outlook Forums, under the technical guidance of WMO RCCs.
- Provide annual progress reports and a final report as soon as the tasks are implemented, but not later than 6 months before the next session.

2. Achievements and deliverables

The work done along this intersessional period was done in a close liaison with CCl works and developments. Among different elements the topics to be discussed were about the standardization of products and services, the impact of the data sharing at regional level (see resolution 60), the resources for the regional level, to reach a better visibility of both RCC and RCOFs activities, to enhance mutual collaboration and synergy within our region but also with the neighboring Regional Associations; namely RA II and RA 1 especially in the frame of the corresponding COFs (NEACOF and MEDCOF).

To avoid any duplication, we focused on the contribution to CCl deliverables instead preparing our own deliverables as they are very relevant for both RCCs and RCOFs and should be available for the next CCl session (in March 2018). The main deliverables of interest in this context are the Guidance on RCCs and RCOFs operations, a Concept note and technical guidance on NCOFs, the reports from the TT-TCI (tailored information) but also from the recent meeting under the umbrella of the ICT-CSIS dedicated to the Climate Service Toolkit (December 2016) and the CSIS operations and coordination (March 2017), meetings where we contributed.

One very important achievement for both our RCC-network and RCOFs is the RCC meeting held in Belgrade (October 2016) with the overall objective to revisit the role, objectives and governance (and Implementation Plan) of the RCC-network in the light of the landscape evolution (GFCS, Copernicus, …). In more details we discussed about the role of the WMO RA VI RCC Network in the wider European context, i.e. in view of recent and ongoing developments like Copernicus, the European Meteorological Infrastructure (EMI), GFCS, etc., the best way to facilitate a sustained evolution of the RA VI RCC Network, also how to facilitate mutual collaboration among RCCs, RCOFs, etc. or to promote application of Quality Management principles in RA VI RCC Network activities, including user requirements and user feedbacks. The report of this workshop is an important document as it contains all the major elements to be considered for a new Implementation Plan for the RCC-Network. It should be available soon (the draft is circulating for approval).

Obviously we contributed to our regional and cross-regional COFs (MEDCOF and SEECOF).
Last but not least, we also contributed to 2 trainings proposed in the frame of our COFs in collaboration with RA 1. The first one was held in Madrid in 2015 and was dedicated to seasonal forecast. The second one was in Roma in 2016 and specifically addressed the verification issues.

3. Recommendations and Way Forward

At the end of this intersessional period, the linkage between the COFs and the RCC-network is effective. However there is a need for the RCC-Network and RCOFS to evolve toward more efficient climate services. These evolutions are reflected inside the outcomes of the Workshop dedicated to RCC-network evolutions and should be taken into account at the next RA VI session and beyond.

Among different topics to be discussed, one can highlight the governance and coordination structure, the evolutions of products and services, the collaboration/coordination with other relevant entities in EU (e.g. Copernicus) or the RCC/RCOFs role with respect of regional users (e.g. European Environmental Agency), the strengthening of the collaboration between neighboring RCCs and RCOFs..

So concretely in the next couple of years, we very likely should:

- Strengthen the service dimension in RCC/RCOFs products including needs for new products and including the linkage with the Hydrological side,
- Improve the feedback process and consequently the reactivity of the RCC and the RCOFs,
- Incorporate the C3S issues inside the RCC/RCOFs processes. (including the impact on the governance)
- Take into account the CSIS aspects (e.g. help desk function, trainings, linkage with the UIP, …)
- Improve the visibility of the RCC and RCOFs activities (outreach).
- The introduction of the climate change dimension into the RCC/RCOFs portfolio need further discussion especially regarding country needs and specificities.

Last but not least, the coordination with existing Technical Commissions, especially thought not only the CCl and the CBS, are crucial for the next and to avoid duplication and optimize the use of resources (especially the volunteers). We should pay a specific attention to the follow-up of the potential evolution in the structures of the Technical Commissions and also the development and implementation of the seamless concept (with the 2019 target).

ANNEX 4

WMO RA VI WG-CH

TASK TEAM CLIMATE WATCH SYSTEM

PROGRESS REPORT 2014-2017
Submitted by Hermann Mächel

1.- Terms of Reference

- To develop guidance for Climate Watch implementation at regional, sub-regional and national level, considering inclusion of hydrological and agrometeorological aspects,

- To develop methods and mechanisms to analyze requirements and feedback on effectiveness, gaps and improvement of Climate Watch implementation at regional, sub-regional and national level based on the pilot projects developed in the previous period,

- To promote enhanced utilization and broadening of WMO RCC Network products and services, ensuring a good coordination with RCCs and RCOFs in the region.

- To provide the annual progress reports in due time before the end of the year and a final report within 6 months before the next session.

2.- Present members of the Task Team on Climate Watch System

- Dr Herman Mächel, Germany (lead)
- Dr Jan Daňhelka, Czech Republic
- Dr Andrea Vajda, Finland
- Mr Christian Viel, France
- Mr Amir Givati, Israel
- Ms Jasminka Smailagic, Serbia

3.- Achievements so far

• A website for the National Meteorological and Hydrological Services (NMHSs) of the WMO Regional Association VI (Europe) was established with protected access to present and past Climate Watch Advisories (http://rcccm.dwd.de/DWD-RCCCM/EN/products/cwa/cwa_node.html). The website is restricted but open for NMHSs (and others) since the NMHSs have the authority for their country to give advisories or warnings. The Climate Watch Advisory needs to be translated and adapted to the local conditions. These details will be explained in the Guidance for Climate Watch Implementation which is the task of this task team.

• Increasing the awareness of the Climate Watch System, by publishing in 2016 an article in the WMO-Bulletin about the successful forecast events of the Climate Watch System with two showcases: the Summer 2015 heatwave in Europe and South European floods in 2015. (Peter Bissolli, Ivan Cacic, Hermann Mächel and Stefan Rösner, 2016: Climate risk early warning systems in Europe. WMO Bulletin 65, 28-31).

• At the beginning of September 2016 the Finish task team member Maria Hurtola was replaced by Andrea Vajda. Contact with Amir Givati and Jan Daňhelka was established. For the task team leader it was possible to meet Amir Givati and Jan Daňhelka during the Hydrology Forum in Oslo.

- An outline of the content of the Guidance for Climate Watch Implementation was written with some additional contributions from Ernesto Rodriguez Camino. A first draft of the Guidance was send to the task team members and their responses are to be consolidated in the next weeks.

- During the WMO RA VI Workshop on RCC Network, 11 – 14 October 2016, in Belgrade, Serbia, suggestions for improvement of the Climate Watch System in the RA VI were discussed.

4.- Challenges

It was a challenge to get in contact with all task team members. Only one member answered the several e-mails. Only one member participated in the first and second teleconference (except Ernesto).

5.- Plan for the rest of the period

Until September 2017: The draft version of the Guidance for Climate Watch Implementation at regional, sub-regional and national levels should be prepared with contributions from all task team members.

There are some questions that need to be clarified:

- How often should Climate Watch Advisories be issued? Only when there is an extreme situation or every week (like the Republic Hydro-meteorological Service of Serbia does it).

- Which platforms should be used for distribution of the CWAs? Which process is foreseen to include CWAs into the new WMO Global Meteo-Alarm System (GMAS).

Annex 5

WMO RA VI WG-CH

TASK TEAM AGRICULTURE METEOROLOGY

PROGRESS REPORT 2014-2017
Submitted by Josef Eitzinger

All results and findings are reflected in the Task Team Final report, including reported case study descriptions

1.- Overall goal and Terms of Reference:

The overall goal for the TT-AM is to review the agrometeorological products and services with the view to improve the implementation and the impact.

The Terms of Reference for the TT-AM include:

- To Identify methods and results of economic studies of agrometeorological products/services and develop recommendations,
- To tailor the agrometeorological services and products at local level, taking into account climate change impacts on the whole agricultural production chain, including related training and education,
- To evaluate hydrological data bases, products and services and explore the opportunities of synergies with the hydrological activities of relevance for agricultural meteorology.
- To provide the annual progress reports in due time before the end of the year, and the final report within 6 months before the next session.

2.- Experts:

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L. Dekic[10]	F. Spanna[12]
D.P. Anastasiou[4]	M. Trnka[13]
P. Struzik[5]	Z. Zalud[13]
M. Kepinska-Kasprzak[5]	A. Utset[14]

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Cooperation on drought related issues with Task Teams Water Scarcity & Drought

(S. Szalai and S. Pecora, A. Susnik)

3.- Reporting schedule and Tasks

Task#	Task	Deliv#	Activity/Deliverable	2014/2	2015/1	2015/2	2016/1	2016/2	2017/1	Responsible	Priority	Status
			WG meeting	x			x		x	Ernesto Rodriguez Camino/Dominique		
	Task Team on Agricultural Meteorology											
	Identify methods and results of economic studies of agrometeorological products/services and develop recommendations	9.1	Review on methods for evaluation of economic impacts of agrometeorological productsd and services							Josef Eitzinger		
		9.2	Description and results of collected case studies							Josef Eitzinger (Schmitt)		
		9.3	Recommendations for improving the capacity and activities on economic impact studies on agrometeorological products and services							Josef Eitzinger		
	Tailor the agrometeorological services and products at local level, taking into account climate change impacts on the whole agricultural production chain, including related training and education	10.1	Literature review/update on operational methods, services and products (global level)							Luigi Mariani (Susnik, Lalic)		
		10.2	Description of related examples of best practices in Europe (within and out of NMHS, case study descriptions, report)							Luigi Mariani (Susnik, Schmitt,		
		10.3	Specific evaluation of operational products/services related to extreme events (i.e. Meteo-Alarm) (Report)							Visnja Vucetic (Mestre)		
		10.4	Evaluation on available data bases/gaps/recommendations (Report)							Branislava Lalic		
		10.5	Recommendations for training and education (Report)							Federico Spanna (Susnik)		
	Evaluate hydrological data bases, products and services and explore the opportunities of synergies with the hydrological activities of relevance for agricultural meteorology.	11.1								Kepinska-Kasprzak Malgorzata (Mateescu)		
	Provide the annual progress reports in due time before the end of the year, and the final report within 6 months before the next session.	11.2								Josef Eitzinger		

4.- Key Deliverables (Results and recommendations)

Task 9: The economic impacts of agrometeorological information in Europe

- -**Economic evaluation methods** differ by the level of criteria applied (i.e. spatial and time scale, type of stakeholder, qualitative vs. quantitative evaluation). There are no guidelines available for economic evaluation of agrometeorological services and products, which should be further addressed in future activities.

- -The reported case studies, however, **proved significant economic benefits of agrometeorological services**, especially in the field of plant protection. For example, the main tasks for saving costs in future plant protection are: exact weather forecasts and prognosis models with finer spatial resolution, a practical use of prognosis system,

an intense pest and disease control and in case of diseases a powerful organization of stakeholders.

Task 10: Tailoring agrometeorological services and products at local level, taking into account climate change impacts/adaptation on the whole agricultural production chain, including related training and education

- Agrometeorology should approach agriculture not only with respect to field activities but with reference to the **whole agrifood chain upstream** the field (seed industry, chemical industry, machinery industry and so on) **and downstream** (storage, food processing, wholesale and retail trade).

- Furthermore agrometeorological activities should **involve** not only agrometeorological services but **also private subjects** (farmers, industries, agronomists, etc.). This is particularly crucial in order to avoid lack of agrometeorological information in case of reduction in public funds.

- **Climate smart agriculture** will introduce into actual farming practices substantial innovation in mitigation, adaptation to climate change/variability issues, and sustainable use of resources. In such actions, agrometeorological/agroclimatological information and advices are fundamental, either to forecast yield and its quality, to support field operations and to optimizing chemicals and energy inputs. **Certification processes of climate smart food** is also under study, as well as some actions to **insure the value of strategic high value crops** (for example grapes and apples).

- Evaluation of available NMHs **METEOALARM** warnings for agriculture: In review of warnings among Regional Association VI, out of 50 members, Meteoalarm warnings are exclusively found on 15 sites and 16 sites have additional warnings alongside Meteoalarm, while Belarus, Lithuania and Republic of Moldova have their own graphical representation. In case of using Meteoalarm for agricultural purposes, warnings can be used in daily operation of planning of works and in protection of crops, orchards and vineyards against hazards. But nevertheless, for purposes of agriculture management, more days should be taken into account when issuing warnings on Meteoalarm. The existing warning information can be used in planning of agricultural activities. However, there is a lack of specific warnings that could be of great use to farmers. On the other hand, at some sites there is no legend description or definition of type of warning. Therefore, it is necessary to recommend some specific guidelines or standards in setting up of representation of warnings on NMS' sites.

- **More intensive exchange of information between NMHSs and agrometeorological networks to reduce agrometeorological data gaps**. NMHSs should take advantage from the fact that possibility to getting more information on the atmosphere, more frequently and from more locations is one of the key elements to improving weather forecasts and warnings in short time scale. On the other hand, NMHSs should be more open for providing access to data related to large and mesoscale phenomena or meteorological variables that vary relatively slowly in time and space (solar radiation) for the purpose of agrometeorological networks.

- **Filling gaps in agrometeorological measurements.** Measurement networks contain data qualitative and quantitative data gaps due to many reasons. There is a few methods for filling gaps (missing values or missing type of parameters such as actual evapotranspiration) which include high level of expertise in meteorological data and management and/or data related to past climate. In both cases, expertise and data base of NMHSs is of crucial importance for filling gaps in AWS data.

- **Real time data from synoptic stations network.** From agrometeorological point of view, assimilation of weather data in real time is of particular importance. On the other hand, protocols of NMHSs identify only exchange of measured data within GCOS (Global Climate Observing System). For other users, that should pass critical control and become available within monthly or annual weather reports. For agrometeorologists it is too late.

- **Availability of numerical weather prediction of different scales.** Application of numerical weather prediction of different time scale, for research agrometeorological purposes, is in its very initial stage. Operational application is not registered. In this case it is not referred to agrometeorological divisions of NMHSs which have free access to NWP products, but on all other interested parties, from producers to researchers and experts. For agrometeorogical analysis, plant and harmful organism growth assessment, numerical weather prediction in form of short term and monthly forecast can be efficiently used as demonstrated by reported case study.

- **Recommendations on evaluation and training evaluation in agrometeorology:**

    - A systematic investigation that takes into account the peculiarities of education systems and agri-food chains of the involved countries.

    - The development of educational programs to introduce students and teachers in the primary and high school grades to the contributions that agricultural meteorologists can make to these issues (Blad, 1994).

    - The reduction of curriculums in agricultural meteorology in order to prepare undergraduate and graduate students to deal effectively with current and future agricultural problems related to agrometeorology (Blad, 1994).

Task 11: Evaluation of hydrological data bases, products and services for agrometeorological issues (in coop. with hydro-meteorological task teams)

- **Cooperation with hydrological institutes:** It is obvious that agrometeorological information and bulletins are prepared and disseminated mostly by meteorological services or agricultural agencies/bodies. This kind of services is mostly based on meteorological data and models, handled by these institutions. However hydrological institutes offer a lot of data and products which are related to agrometeo issues. These kind of products can complement and improve services for farmers, therefore the cooperation with the hydrological institutes allow for understanding of all issues.

- **Drought - Cooperation with other expert teams:** Over the past thirty years we observe the increase of extreme weather events. Also number and intensity of all kind of droughts (meteorological, agrometeorological and hydrological) have dramatically increased in Europe. It causes decrease of availability and growth of demand for fresh water. Water scarcity and droughts have a direct impact on the environment and on all sectors, which use and depend on water. In such situation, it would be very valuable and beneficial, to create a common platforms to monitor and manage drought and water deficit at regional, national and European level for all groups of users, particularly for farmers. In many countries meteo, agro and hydrological services offer services and products informing about the actual situation and drought risk. Unfortunately these services often belong to different institutions (ministries) and do not cooperate and do not provide any data exchange. Therefore such platforms offer small-scale information, dedicated for narrow groups of end users. The collaboration with other expert teams could allow to search a new possibilities of cooperation and for establishing the common recommendations for services for building the common, regional or national

platforms providing all kinds of information concerning all kind of droughts, showing maps of actual situation and risk on all drought-level i.e. meteorological, agrometeorological (soil) and hydrological (surface and ground water) droughts. It would be very profitable solution mainly for agrometeorological purposes but also for other groups of interests.

- **Satellite data use for agrometeorological services and products:** An information concerning the spatial and temporal resolution of basic ground observations indispensable for agrometeorological needs differs significantly from country to country, but the density of the measurement network depends mostly on the meteorological element – for example there are many stations with lots of precipitation measurements and with very little with sunshine duration and radiation. Such elements as soil moisture and evapotranspiration are not measured practically in most of the countries. On the other hand, the knowledge about actual values of all these elements is crucial for agrometeorological services. Earth observation techniques in combination with ground observation deliver more and more precise products, related to hydrological and biophysical cycle. It is related partially to rapid development of hydrological applications demanding assimilation of satellite data and from the second hand, free availability of high resolution data from Sentinel satellites fleet. Unfortunately such products are actually used mainly by scientists. **Demands for agrometeorological services based on Sentinel data ought to be placed to Copernicus Programme, stimulating in this way, creation of value added services for farmers.**

- The most attractive feature of remote sensing is spatial and temporal coverage, especially in scarcely populated areas, where ground observations are limited. Examples of such products merging satellite and ground observations are products concerning: soil moisture, snow cover, evapotranspiration, climatic water balance and advanced models for determination of water requirements/deficit for individual plants.

- **Availability of satellite data** related to soil and biosphere conditions. NMHSs are institutions which should be interface between EUMETSAT and national users. At this moment, from web pages of many NMHSs it is not obvious how to get satellite data information.

5.- Key Conclusions and Lessons learnt

- It is time consuming and difficult to get an overview in agrometeorological applications and research with only few involved experts

- Research Institutions, Universities, ministries, weather and hydrological services (both private and public sector) and addressed STAKEHOLDERS have better to interact and cooperate in interdisciplinary manner in order to IMPROVE and IMPLEMENT agrometeorological methods at the stakeholder level.

- There is a need to force regionalized, tailored, up-to date services for various stakeholder groups and sectors (example drought monitoring)

- Use of scientific conferences for following actual research activities, not only in the field of (agro)meteorology but in related research fields such as hydrology, agronomy, plant protection, remote sensing, agricultural technology development etc.)

- Use of modern communication technologies can help significantly

- Common Platform (i.e. marketplace) should be established for:

- organizing Know-How / Best practice exchange,
- cooperation in implementing operational applications,
- supporting data exchange, gap filling for i.e. agromet. purposes

ANNEX 6

WMO RA VI WG/CH

TASK TEAM WATER SCARCITY AND DROUGHT

PROGRESS REPORT 2014-2017

Submitted by Silvano Pecora & Sandor Szalai

0. Background

- Team: Sandor Szalai (Hungary), co-leader; Silvano Pecora (Italy), co-leader; Zita Bihari (Hungary); Antonio Mestre (Spain); Ernesto Rodriguez Camino (Spain); Conception Garcia Gomez (Spain); Eric Sprokkereef (The Netherlands);
- WMO RA VI Operating Plan for 2012-2015: expected deliverables;
- Resolution 10((RA VI-16) on the WG CH;
- WMO RA VI MG/2-2014/Doc.4.3: establishment of the TT WSD for the period 2014-2017

1. Terms of Reference

- Review and strengthen the drought monitoring systems, especially the development and the implementation of the methodologies as well as the application of the related information by users, in RA VI countries, considering the existing mechanisms, as well as the deficits in drought information services;
- Provide guidance on water scarcity and drought characterization, including different analysis of drought episodes, providing algorithms and tools to monitor the temporal evolution of a drought event and to perform an appropriate assessment of a drought;
- Review the analysis of climate change impacts on water scarcity and drought by regional climate simulations, downscaling global climate projections, coupled with the hydrological and water balance modeling chains, simulating the available water distribution in river basin and considering water demand;
- Improve knowledge on water resources available in the European basins and the use, assessing potential impacts of management, technological and economic measures to reduce the vulnerability of the territory against the desertification, water scarcity and drought;
- Identify the scope for, and implementation of, Integrated drought management w.r.t. water resources and agriculture;
- Provide annual progress reports in due time before the end of the year and a final report as soon as the tasks are implemented, but preferably not later than 6 months before the next session.

The TT Work Plan 2014-2017 was developed in accordance with the following scheme:

Task Team on Water Scarcity and Drought					
ST	Issues /Themes	Task#	Task	Deliv#	Activity/Deliverable
C+H	Socio-Economic Benefits	12	Develop regional guidance on methodologies for assessing socio-economic benefits of weather, climate and water services	12.1	Review and strengthen drought monitoring systems, especially development and implementation on methodologies as well as application of related information by users, in RA VI countries, considering existing mechanisms as well as deficits in drought information services;
				12.2	Guidance on water scarcity and drought characterization, including different analysis of drought episodes, providing algorithms and tools to monitor the temporal evolution of a drought event and to perform an appropriate assessment of a drought.
				12.3	Review analysis of climate change impacts on water scarcity and droughts by regional climate simulations downscaling global climate projections, coupled with hydrological and water balance modeling chains, simulating the available water distribution in river basin and considering water demand.
				12.4	Improve knowledge on water resources available in European basins and their use, assessing potential impacts of management, technological and economical measures to reduce the vulnerability of the territory against desertification, water scarcity and drought.

It was presented at the first WG CH meeting on 23.9.2014 in Warsaw (Poland) and modified according to the meeting outcomes.

2.- Key deliverables

- Periodic Telecons and Annual Reports
- International conferences participation
  - ECCA, EWAS2, WMO (RA VI, CHy-15), UNCCD events
- Data and analysis
  - CarpatClim, EDO, data brokering and standardization (WMO services), data homogenisation, publications
- Monitoring
  - Hydrological monitoring; soil moisture (Remote sensing, in situ-model harmonisation)
- Adaptation
  - Mountain regions; Enhance FP7 Project; Center for Water Sustainable Development and Adaptation to Climate Change (WSDAC, Serbia)
- Capacity building and networking
  - DMCSEE (WMO and UNCCD); EDO, EDC
  - IDMP (project and follow up); GWP/GWP CEE
- European/international programmes and projects (FP7, H2020, INTERREG)
  - Climate KIC-FWOO; Copernicus C3S; Central Europe Proline-CE; FP7 ENHANCE; Danube Transnational Projects (JoinTisza, DriDanube), UNCCD projects

In 2015, TT co-leaders supported the “Adaptation policies and measures in the Mediterranean Region” session of the European Climate Change Adaptation Conference (ECCA. May 12-14, 2015. Copenhagen, Denmark). Silvano Pecora was session co-Chair and co-Author of “Climate variability and change in the Emilia Romagna Region – Regional Climate atlas“(Western Europe); Sandor Szalai was co-Author of “Adaptation in the water sector in Hungary” (Eastern Europe).

During 2015 Sandor Szalai with Gregor Gregorič promoted coordination with the Drought Monitoring Center for South Eastern Europe (DMCSEE). Different actions were discussed, among which: trying to expand bulletins, workshops and projects; support initiatives on remote sensing catching and common opportunities with flood management (Workshops on drought and remote sensing organized by DMCSEE); extend to RAVI and share with NHSs initiatives about the

Integrated Drought Management Programme Central and Easter Europe (IDMP-CEE) and the Global Water Partnership for Central and Eastern Europe (GWP–CEE).

The FP7 collaborative Project ENHANCE (Enhancing risk management partnerships for catastrophic natural hazards in Europe) allowed TT members to work together with partners from all over Europe and different public and private sectors (public organisations, banks, insurance companies, research institutions). Through case studies in Italy and Spain, it embraced drought modeling and characterization (run method via copulas, SPI, SFI), water balance scenarios and future drought impacts with the overall goal of augmenting economic, social and environmental resilience. Capitalization of this experience moves toward extending Multi Risk Management/Multi Sectoral Partnerships and voluntary commitments at RAVI Scale and for other European Basins as also to further develop Best Practice and Methods in Designing Site-Specific Scenarios. The Run method applications performed in Enhance can also be extended to the study “prolonged droughts” as also SPI and SFI tools for drought characterization. A first review of WSD early warning system and related application (ecology, ground water, floods, oil spill, salt intrusion, WRM) has been implemented on the basis of recent events (European Drought in summer 2015, EDO 2015).

Intermediate TT telecons were held in September and December 2015.

The importance of sharing expertise, tools and methodologies and fostering cooperation among different partners in order to find innovative solutions for salt intrusion effects in economic vulnerable regions projects emerged in the EU Climate KIC FWOO (Fresh Water Option optimizer), with participants from Spain, Italy and the Netherlands. Local solutions (storages, differential drainages/piping, seasonal management, interconnected networks) has been investigated trough distributed/cost benefit analysis. Case studies were in Spain (Veja Baja Segura, Vinalopo), Italy (Po) and the Netherlands.

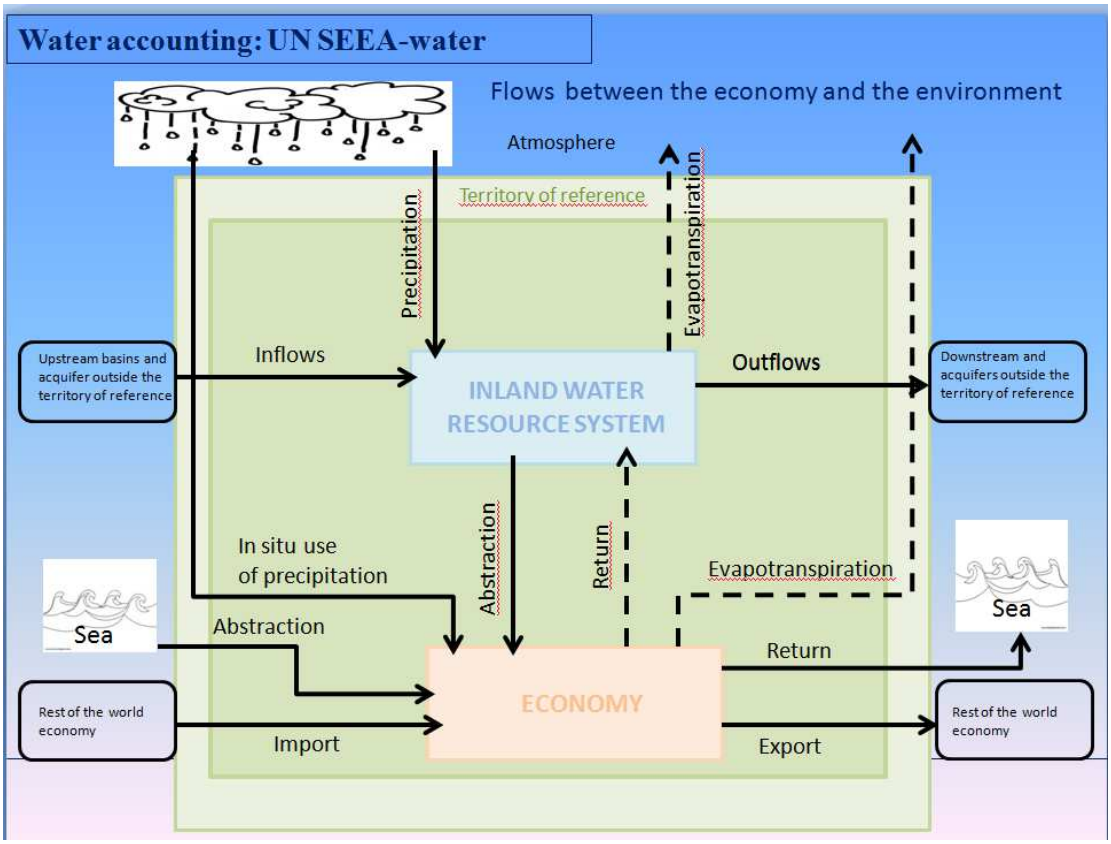
The Central Europe PROLINE –CE puts together partners from Austria, Slovenia, Hungary, Poland, Croatia, Italy Portugal and Germany aimed at developing methodologies and good practices for sustainable management of catchments on transnational comparable level. The project is intended to develop Pilot Actions reflecting possible conflicts with drinking water protection such as forest ecosystem services, land use planning, flooding, climate and land use changes, in the framework of local legislation.

Knowledge on water resources available in European and RA VI received a strong tribute from case studies on the implementation of the UN System for Environmental Economic accounting of water (UN SEEA-Water). Applications in basin located in Italy, Spain and Greece has been presented at the Efficient&Sustainable WAter Systems Conference (EWAS22016, held on June 2016 in Crete, Greece).

The Conference was announced in the WG HC telecon on 26.12.2015, together with the promotion of INTERREG V transnational 2014-2020 cohesion programme ADRION.

In 2016 Silvano Pecora was co-author of “Water accounting in the Po river basin applied to climate change scenarios”(EWAS follow-up, 2016). In this study a modelling chain was applied for the development of water accounting analysis in the Po River Basin, including the impact of climate change on the region. To do this, the climate change impacts have been obtained under the Intergovernmental Panel on Climate Change scenario RPC4.5. The hydrological/hydraulic components are simulated through a physically based distributed model (TOPKAPI) and a water balance model at basin scale (RIBASIM). The accounting approach has been the SEEAW. The

results show that, in future scenarios, the application of measures will be required to mitigate climate change maintaining water allocations.



In spring- summer 2016 the TT, together with members from the WG and the WMO Secretariat, was involved in developing a proposal for Copernicus Climate Change Services (C3S) in charge of ECMWF. Proposal touches the European Unified Climate Data Store (CDS), Data access to Climate Archives (NHSs, Data Centres), Data and metadata Harmonsiation, Homogenisation (including Transboundary), Quality Control, Help desk/Users Forum.

All the task team worked for the preparation to the Hydrology Forum and WG CH Meeting held in September, 2016 in Oslo and for developments here required.

In the same September, 2016-there was the participation of the TT to Kick off meeting of the Interreg Central Europe Proline-CE (Best practices and management of river basins (Munich, Germany)

During the intersession period, the TT was also involved in low flows measurement development, though implementing the Quality Management System for discharge measurement. Draft documentation includes quality manual/objectives, procedures and operational instructions, modules for records, working agenda. Findings for the CHy Survey on the status of the QMS in NHSs has been presented in the CHy- 15 (Rome, Italy 7/13 Dec. 2016).

In November 2016t there was the drafting of Annual Report 2016 and in December it was implemented the study of salt intrusion at the conclusion of ENHANCE FP7.

Other activities:

- Climate KIC- FWOO final meeting. Operational implementation for comparing Fresh Water Option Optimizer
- Implementation and scheduling of webinars for 2017
- Publication, reporting and education with the Drought Management Centre for South-East Europe – DMCSEE
- EU/World Projects: UNCCD DRAMP Drought Resilience, Adaptation and Management Policy
- Networking with NHMSs in RAVI
- Preparation of Sheared Vision actions in the frame of ongoing projects (JoinTisza, DriDanube)

2.- Key conclusions and lessons learnt

- Many valuable results, but mosaic applications needing a better information flow
- Drought is a many players topic, many different organisations, many centres, different information
- Technical details could identify common important activities
- Ongoing call for proposals offer very good opportunities
- Telecons are useful, but discussed topics should be balanced (great importance should be dedicated about what we will do instead of what we have done)
- Event dependent (political interest and support is in the drier period only)
- Missing harmonisation (different indices, even one index has different calculation methods)
- Water assessment review (Resources for the more suffered but less developed countries)

3.- Key Recommendations for the Way Forward

- Promotion of networking and active participation in hydrological programme should be strengthened
- Stronger co-operation is requested, state-of-the-art situation on the areas with many different approaches (vulnerability and risk assessment, etc.) Harmonisation procedures to increase the comparability and a better regional overview
- Task Teams could propose some common developments, which will improve the strategy of the Working Group Climate and Hydrology
- Expanding current activities and the Task Team composition
- Sharing operational experiences Networking among National Hydrological Services
- Supporting capacity building (distance learning, guidelines, webinars, cooperation platform)
- Supporting cross cutting themes (management, transparency, infrastructure, analysis)
- Promotion of common project proposals
- Hydraulic infrastructures integrated management

Budapest-Parma, 5 May 2017

WMO RA VI WG-CH

TASK TEAM HYDROLOGICAL MODELLING, FORECASTING AND WARNINGS

PROGRESS REPORT 2014 – 2017

Submitted by Eric Sprokkereef

1.- Terms of Reference for the period 2014-2017

The Task Team on Hydrological Modeling, Forecasting and Warning is required to:

- Follow up of, coordination with and support to, EFAS and FFGS as well as other WMO CHY and EC related activities.
- Organize, back to back with the next Hydrological Forum, an RA VI Workshop-training on hydrologic modeling, forecasting and warning services.
- Identify and follow up the relevant project/activities in RA VI (with focus on transboundary hydrological modelling) and disseminate the outcomes to the RA VI Members.
- Follow up the development of the WMO FFI proposal for a Framework for the assessment of service Delivery capabilities of hydrological services.
- Introduction of the Framework to the RA VI community and collection of the RA VI Members' feedback.
- Provide annual progress reports in due time before the end of the year and a final report as soon as the tasks are implemented but not later than 6 months before the next session.

The Team was composed of the following experts:

1. Cristina Alionte Eklund (Sweden), leader till September 2016
2. Emmanuel Roulin (Belgium), member
3. Tomas Vlasak (Czech Republic) , member
4. Amir Givati (Israel), member
5. Jon Skoien (JRC), member
6. Peter Salamon (JRC), member
7. Eric Sprokkereef (The Netherlands), member and leader after September 2016
8. Michal Kasina (Poland), member
9. Dejan Komatina (Sava River Commission), member
10. Daniela Kyselová (Slovakia), member
11. Maria Conception Garcia Gomez (Spain), member
12. Ayhan Sayın (Focal Point of the Regional Centre for Black Sea, Middle East and South Eastern Europe Flash Flood Guidance System), member

13. Slobodan Nickovic (Serbia), member

14. Hervé Colleuille (Norway), member

2.- Activities and Key Deliverables

The Task Team made extensive use of teleconferencing to coordinate the work.

Activities related to the relevant Terms of References:

1. The TT followed the latest developments within EFAS. EFAS is part of the Copernicus Emergency Management Service. For the operational management of EFAS a new contract has been signed in 2015. The operational EFAS consortium did not change with respect to the Computational Centre, the Hydrological Data Collection Centre and the Dissemination Centre. There are plans for extension of the EFAS domain to cover the whole RAVI area. TT member Eric Sprokkereef is also active within the EFAAS Dissemination Centre, therefore the connection between the TT and EFAS is guaranteed.

   Through TT member Ayhan Sayin, WMO/Turkey the TT has been informed on a regular basis on the latest developments within the WMO FFGS. The FFGS is implemented in 9 countries in south-east Europe. Training activities for the users were performed.

   The TT members recognized the synergies of closer cooperation between FFGS and EFAS. Therefore a representative from WMO FFGS was invited to the EFAS Annual meeting 2016 that took place in Seville Spain.

Through TT member Peter Salamon (JRC) the TT was informed about the activities of Working group F (Flood) of the EC. This working group consist mainly of national authorities in charge with water management and planning and/or Civil Protection authorities and looks at how the EU Flood Directive is implemented.

2. The TT has organized prior to the WMO Hydrological Forum on 20 September 2016 a Workshop on hydrological modelling, forecasting and warnings. The workshop was organized in three sessions, respectively on Hydrological forecasting, warning and communication with end-users, Remote Sensing and Hydrological Modelling, Forecasting and Warning and Flash Floods and Urban Floods. All the 18 presentation are available on line at the address: http://www.wmo.int/pages/prog/hwrp/RA6/hydroforum2016.php

   One of the main questions that came out of the workshop was how NHSs could contribute and benefit from METEOALARM. It was noted that METEOALARM is using hazard threshold (return period) which is a step back from risk threshold, that should be already available in many countries and impact based alarms are being developed and in general it would need some adaptation to be able to handle hydrological alarms. These issues shall be discussed at the planned EFAS METEOALRAM meeting in March 2017, keeping in mind also that METEOALRAM addresses the general public and EFAS is restricted to NHSs, and the latter can play an important role in linking the two initiatives, and in general their role should be enhanced when discussing on MHEWS.

   Participants of the workshop recalled that disaster management are national responsibility and stressed that national laws and regulations should be taken into account, and therefore it may be necessary to consider the involvement and contribution of Civil Protection. Also the debated indicated that evaluation of forecast may be a topic for work in future and that it might be appropriate to review the CHy Statement on the Scientific Basis for, and Limitations of, River Discharge and Stage Forecasting, to add specific considerations regarding flash flood.

3. An document has been created with an overview of ongoing and planned projects activities in RAVI focused on transboundary hydrological modelling. The document contains information on EFAS, E-HYPE, FFGS, transboundary hydrological cooperation in the river basins of the Rhine, Moselle/Saar, Sava and Danube.

   A draft proposal was compiled on sharing best practices in using probabilistic forecasts.

4. Tasks 4 and 5 are connected to overall activities within CHy. There are no relevant deliverables.

3.- Key Conclusions and Lessons Learnt

In the last meeting of the WMO Working Group on Climate and Hydrology a reflection das been made on the past three years. Many of the TT leaders concluded that the lengthy process for the nomination of national experts has resulted in a very delayed start of the activities, and in not uniform regional coverage of expertise and inputs. Furthermore not all appointed experts showed the expected level of commitment and willingness to contribute to the Task Team activities. While some TT leaders relied on previously constituted personal network of experts, it was recognized that this approach, though allowing a more efficient work, entails the risk of restricting the scope of the activities and limits access to the whole array of information and expertise.

It was also noted that too often the ToR of the Task teams are too ambitious including too many and far reaching activities, few of them being eventually implemented.

Another conclusion is that the linkage with the work of the relevant WMO Commission for Climatology (CCL) and Commission for Hydrology (CHy) should be further reinforced, for optimizing the synergy of work and activities.

Various videoconferencing tools tried in the recent times (Webex, BlueJeans, etc.) all presented some technical issues that made difficult and occasionally impossible the attendance of some members.

The benefits of having a joint group addressing climatological and hydrological issues has been openly debated. It was felt that the joint working group has been instrumental in improving the mutual understanding of the priorities and needs of each discipline, but it was also recognized that many priority topics exist that do not necessarily draw special benefits from this arrangement. Similarly, issues dealt with in the other working groups on Service Delivery and Partnership and on Technology Development and Implementation are very relevant to both climatology and hydrology but efficient collaboration has not yet been established, typically a dedicated body to deal with issues related to climate services is not existing. It was also recalled that important initiatives, such as the Global Framework for Climate Services or the EU Copernicus program have launched since the WG was first established in 2009, and the WG relations with them should be taken into account.

4.- Key Recommendations for Way Forward

The general idea is that the Task Team should play a role mainly as a platform for exchanging ideas and solutions and share experiences (data, techniques communication with end users, etc.) and mapping the present situation in Europe. The Task Team recognizes the need to improve communication by electronics means and further promote the use of webinars, electronic newsletters, web pages, and virtual discussion forum to debate issues of common interest. It was also pointed out that often it is more educational to share failures and setbacks and retrospective analyses how to avoid them.

It is recommended to adopt more realistic Terms of References, limited to one or two well defined and reachable objectives. On the basis of this recommendation the Task team proposes to concentrate on the following topics:

- Use and improvement of meteorological input for hydrological models for flood, drought and seasonal forecasting: Ensemble Precipitation from various models, global vs. regional, models as input for other models, soil moisture to update initial condition of hydrological models;

- Improving flash flood forecasting and warning. E.g. link WMO FFG with EFAS and use the developments of flash flood forecasting in EFAS;

- (Assess the need for) impact based warnings;

- Global forecasting systems as complementary, added value services for national/regional forecasting systems. E.g. WMO Global Data Processing and Forecasting System, EFAS, GLOFAS

- Validation of forecasts (including ensemble forecasts)

The Task team stresses that the ultimate goal of the Task Teams work is to produce outcomes useful for NMHSs. Hence the dissemination of results should be improved not only by publishing on public web sites, but also by communicating them to potential users, and a greater involvement of NHSs should be sought during all the development phase.

ANNEX 7

WMO RA VI WG-CH

TASK TEAM DATA OPERATIONS AND MANAGEMENT

PROGRESS REPORT 2014 – 2017

Submitted by Jose Antonio Guijarro & Harry Dixon in 2017

1.- Terms of Reference

- Maintain and improve the existing RA VI / CCl Website on Data Rescue, including information on available digitized data, data rescue projects, homogeneity methods, methodologies of data rescue.
- Support the design and optimize of monitoring networks (with support from the Hydrological Forum).
- Provide support to standards development.
- Maintain support for monitoring systems.
- Encourage the harmonization of methodologies for quality control and access to data.
- Promote data exchange and sharing.
- Provide annual progress reports in due time before the end of the year and a final report as soon as the tasks are implemented but not later than 6 months before the next session.

2.- Key deliverables (with reference to the web pages for a more detailed information)

Maintaining a Regional Web-based Information Source for Members:

The TT-DARE website developed in the former inter-session period was adapted to reflect the new WG structure. All sections relevant to TT-DOM were transferred to http://www.climatol.eu/tt-dom/index.html and new hydrological contents and other updates provided by TT members were added. Updates included the addition of information on the use of proxy data in hydrology.

Promoting Open Data Policies:

A special article was published in MeteoWorld detailing the recent Israel Meteorological Service experience in moving from a paid to a free business model for data. This deliverable was designed to promote further policy changes by other members. The publication is available here.

Harmonizing Data Management Methods:

The TT-DOM maintained liaison with a number of other key data management initiatives, both within the region and more widely. In relation to the standardization of methods and procedures, over the intersessional period TT Members were involved in a new piece of work to develop a European CEN (Comité Européen de Normalisation) standard for Hydrometric Data Management (as Chair of CEN TC318 WG17. It is hoped that the new standard will serve as a reference to RA VI members.

Contributing to Data Standardization:

TT Members were engaged in the joint OGC/WMO development of data standards such as WaterML2.0 and a WIGOS metadata profile (as part of the Hydrology Domain Working Group). Engagement in this work during the development phase ensures that RAVI Members are in a stronger position to adopt these new standards into operational practice. A summary of this work is available at the CHy Pre-Session e-forum site.

Supporting Data Sharing

TT Members and other external collaborators came together in 2016 to submit a join proposals to a European Commission tender call from the ECMWF related to ECMWF the *Collection and Processing of in Situ Observations*. At the time of writing the results of this proposal are not known however, while not a direct output of the TT, the experience does underline the knock-on benefits from the improved linkages which WMO is promoting in the region.

3.- Key conclusions, lessons learned

Technical Conclusions:

Capacity Development in Data Quality Control and Access Methodologies:

The TT discussed the issues of data quality control and the communication of uncertainty in climatological and hydrological data, agreeing that these were major issues for the Region. The possibility of workshop to share QC practices was explored as it was felt this would be useful to a number of Members. The TT concluded that financial support from WMO would be vital in ensuring good engagement with such an event and that there would not be an opportunity to hold such workshop during the current inter-session period. The TT recommend that the possibility of such an event should continue to be explored within the region.

Supporting Data Exchange and Sharing:

The TT agreed on the importance of supporting the activities of the GRDC and CHy's new World Hydrological Observing System (WHOS) initiative. The latter is being developed in two stages: Phase 1 is live and allow users to see links to NHMSs where hydro-metric data can be found. Phase 2 of the WHOS will allow dynamic access to data. In order to develop this, information is needed about which NHMSs are making data available via the web and what technologies are being used. The TT discussed how best it could support the development of the WHOS and agreed that assisting in the development a number of pilots implementations within the region over the next intersessional period would be beneficial.

Additionally, in order to support Members both in their adaptation to new data sharing technologies and in changes to data policies, the TT agreed that an assessment of the current status of RAVI hydrological data dissemination would be useful. This should not aim to cover all countries in detail but rather provide an overview using case studies of what a subset of NHMSs were doing, including the current policies of data dissemination and the technologies used. On the climate side, it was noted that sharing of data was still a major issue, although some members are moving to an open data policy. The case of the Israel Meteorological Service is paradigmatic, and as such it was used as a case study deliverable of the TT.

Support for Monitoring Systems:

While the ToR for the TT proposed focus on both data management issues and underlying observational issues, the Membership was made up of experts whose focus was mode aligned with the former. For example, the TT included experts in data management, quality control, homogeneity methods and data sharing but few on hydrometry or instrumentation. As such the TT did not take forward specific activities focused on supporting monitoring systems however, in discussions, the TT agreed that this was an area which should be included in future RAVI WG

activities – a view which was supported by the conclusions of the 3rd RAVI Hydrology Forum in 2016.

Organizational Conclusions:

Enhancing Task Team Membership:

Having few pre-nominated experts, significant effort was required to approach the community, find members and request PR nomination. This delay the start of the TT work. It would be useful to discuss ways of optimizing the process of attracting dedicated experts.

Improving TT Communications:

The TT successfully used web-conferencing as a means of communication during the intersessional period. Meetings were intended to be held every 3 months, although some delays were introduced to adapt to the agendas of the participants. These frequent e-meetings allowed timely discussions on the tasks progress and further steps to address. The TT discussed the best web-conferencing software for its meetings and agreed that Skype meetings would be used. For the next intersessional period however it would be useful if WMO could provide web-conferencing capabilities and ensure all Members can easily access these.

All minutes of TT meeting and other relevant documents were made available in the document management system implemented at https://sites.google.com/a/wmo.int/ra-vi-working-group-on-climate-and-hydrology/file-cabinet-for-the-task-teamss/tt-dom. While this worked fine, there were issues with granting access to TT Members which introduced delays. It would be useful to optimize this in future.

Optimizing TT Terms of Reference:

The TT felt that its ToRs were not achievable given the resources and time commitment available. As such some internal prioritization had to take place. For example, during the TT discussion on Support for Monitoring Systems, it was felt that other areas of the ToR already provided that support, and further specific activities in this area were not pursued. For the next intersessional period, it would be beneficial to confine the ToRs for each TT to a smaller number of time limited deliverables.

The TT felt that there is potential to build more specific links with other areas of WMO's activities. A number of the TT Members attended meetings of the RAVI Hydrology Forum over the intersessional period and this is a good example of where greater links should be encouraged between the WG and other WMO initiatives in future.

4.- Key recommendations for the way forward

The key recommendations of the TT are as follows:

i. Many Members in the region still face significant issues related to the collection and management of meteorological, climatological and hydrological data. While there is significant benefit in the use of TT to share information within the Region, more targeted and achievable activities (which are closely aligned with the work of Technical Commissions and have adequate resourcing) are required to build capacity amongst Members.

ii. The recruitment of TT members should be improved in order to allow an early kick-off of TT activities supported by committed experts.

iii. TT ToRs should be concise and focused on time-limited deliverables. There is a need to avoid long list of, sometimes overlapping, activities and limit ToRs to a few key distinct activities.

iv. Although there are common areas of interest, many of the issues and priorities related to Data Operations and Management are differ between the Climate or Hydrology domains. It might therefore be useful to split any future TTs in this areas into domain specific ones, the focus on their particular problems but maintain cross-disciplinary interaction where needed.

4.- Recommendations for the next intersession period

Taking note of the first draft of WMO Strategic Plan 2020-2023, approved at the EC-69/Doc.16.2(1), the focus will be put on three overarching priorities:

(a) **Reducing losses of life and property** from hydrometeorological hazards;

(b) Supporting climate action to build **resilience and adaptation to climate risk**

(c) **Enhancing socio-economic value** from hydrometeorological and climate services

The Long-term Goals associated with the priorities are:

Goal 1: Better serve societal needs: Delivering actionable, authoritative, accessible, user-oriented and fit-for-purpose services.

Goal 2: Enhance Earth System Observations and Predictions: Strengthening the technical foundation for the future.

Goal 3: Advance targeted research: Leveraging leadership in science.

Goal 4: Close the gap on service: Enhancing and leveraging existing capabilities among all WMO members to bring capability to all.

Goal 5: Work smarter: Supporting effective policy- and decision making and implementing in WMO

Taking note of the draft priorities of the region as from the 5-th RAVI Management Group meeting, Vilnius, Lithuania, 26-28- April 2017 (to be further discussing during the upcoming RAVI-17):

(a) Multi-hazard Early Warning Systems and Impact based forecast;

(b) Earth Observations, including WIGOS/WIS implementation at the regional level;

(c) GFCS implementation

Taking account of the recommendations of the RA VI WG-CH Task Team members, the Working Group on Climate and Hydrology recommends:

(g) WG activities will cluster around two poles (Hydrology and Climatology) and each Task Team will have a composition reflecting the proportional relevance, contribution and interest of each of the two domains. The Clusters will address specific climate, respective specific hydrological activities of the region, as recognizing the differences between climatological and hydrological activities with regard to time and space scales, and methodologies. The new proposed structure is seeking a better alignment and connectivity with the activities of the Technical Commissions (Commission for Climatology and Commission for Hydrology). The link between the two Clusters will be through Joint activities on implementation of Climate Services (see Annex 11).

The WG CH major contributions focus on the expected results, as follows:

ER1: Enhanced capabilities of Members to deliver and improve access to high quality weather, climate and water and related environmental predictions, information and services in response to users' needs and to enable their use in decision-making by all relevant societal sectors.

ER2: Enhanced capabilities of Members to reduce risks and potential impacts of hazards caused by weather, climate and water and related environmental elements.

ER3: Enhanced capabilities of Members to produce better weather, climate, water and related environmental information, prediction and warnings to support in particular climate impact and adaptation strategies.

ER6: Enhanced capabilities of NMHSs, in particular in developing and least developed countries, to fulfil their mandates.

(h) With the view to facilitate the implementation of the above listed tasks, to compose the Working Group of:

(i)

- a co-chairperson on Climate, coordinating the specific activities of the Climate Cluster and facilitate the connectivity with the Hydrology Cluster and the Joint Actions on Climate Services;

- a co-chairperson on Hydrology, coordinating the specific activities of the Hydrology Cluster and facilitate the connectivity with the Climate Cluster and the Joint Actions on Climate Services;
- Task Team leaders;

- Rapporteurs, and

- Other volunteer experts, as necessary.

(j) The activities, relevant task teams and their leaders should be identified ideally already during the session, on the basis of nomination solicited from Member in response to the proposed topics identified in this report. This in order to minimize the lag time between the session and the real beginning of the WG activities.

(k) With the view to optimize the creation of different Task Teams, to make the needed arrangements in order to identify and nominate experts using a quick and efficient procedure aiming to recruit the actual experts in their respective fields for the different Task Teams.

(l) To limit the Task Teams' Terms of Reference to a few well-defined and reachable objectives consistent with the resources and time commitment available. Objectives should ideally be linked to concrete deliverables.

(m) To take due note of the specific recommendations from different Task Teams listed in the corresponding reports summarized in Annexes 1-6.

ANNEX 10

Proposed structure of the Working Group on Climate and Hydrology

The Working Group on Climate and Hydrology proposed to re-establish for the next intersessional period the same Working Group with an updated internal structure where two different clusters, the ***Climate Cluster*** and the ***Hydrology Cluster***, are identified. The Clusters will address specific climate, respective specific hydrological activities of the region, as recognizing the differences between climatological and hydrological activities with regard to time and space scales, and methodologies. The link between the two Clusters will be through Joint Activities on implementation of Climate Services.

The new proposed structure recognizes and addresses the differences between climatological and hydrological activities and at the same time ensure a better alignment and connectivity with the activities of the Technical Commissions (Commission for Climatology and Commission for Hydrology). This new structure is expected to make working procedures and meetings more effective, as it allows a certain degree of autonomy, for both climate and hydrological communities, to make the needed arrangements when dealing with very specific issues only affecting to one or another community of experts.

This new organizational proposal arises after an open process of dialogue and discussions within the WG-CH and a consultation process with the Regional Hydrological Advisers, and after analyzing working procedures and identifying some deficiencies of the past structure during the last intersessional period. At the same time, this new arrangement for the WG-CH points to strengthen the hydrological services and their visibility at regional level. Finally, the new structure will facilitate a more efficient coordination with the activities of the Hydrology Forum.

The **Climate Cluster (WG-CH-CC)** will comprise in the proposed structure the following Task Teams:

- **TT on Regional Climate Centres and Regional Climate Outlook Forums**
- **TT on Climate Watch Systems**
- **TT on Climate Data**

Whereas the **Hydrology Cluster (WG-CH-HC)** will comprise the following Task Teams:

- **TT on Hydrometry and Data Management**
- **TT on Hydro forecasting and warnings**
- **TT on Water Resources Management**

Both Clusters will be strongly intertwined for the development and implementation of joint actions on Climate Services concerning to both communities of experts. These joint actions on Climate Services will be initially developed by the existing **TT on Agriculture Meteorology**, although the WG envisages the possibly to expand these joint actions into other relevant sectors for RA VI.

Associated to the new proposed structure, there will be a project-like way of functioning with Terms of Reference for the Task Teams limited to a few well-defined and reachable objectives, consistent with resources and time commitment available. These objectives should ideally be linked to concrete deliverables and actions aiming to establish a better and clearer connectivity with operational products and services.

Figure 1 allows a straightforward visualization of the proposed structure for the Working Group on Climate and Hydrology showing the two clusters on Climate and Hydrology and Joint Actions on Climate Services. The proposed TTs are included in the corresponding boxes. The box corresponding to Joint Actions on Climate Services contemplates the possible extension to other relevant sectors.

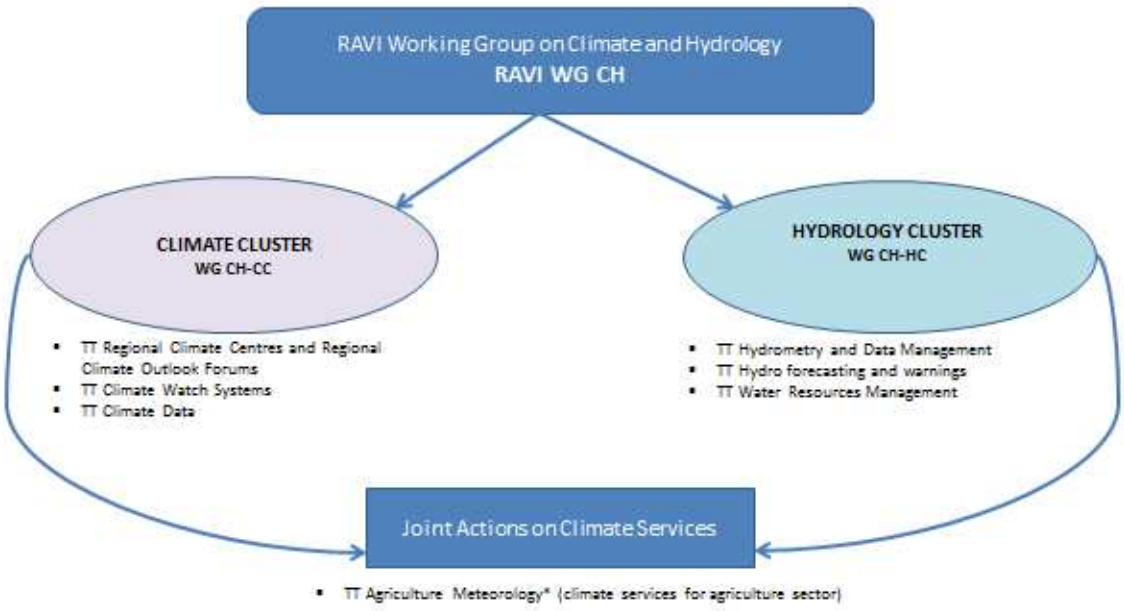


Figure 1.- Structure of the proposed RAVI Working Group on Climate and Hydrology including two clusters on Climate and Hydrology and Joint Actions on Climate Services

Figure 2 shows the Tasks Teams integrating the Working Group on Climate and Hydrology represented within a triangle with vertices corresponding to climate information, water information and elaborated climate services. The proximity to the vertices indicates how much related are different TTs to input climate/water information and to output elaborated services/products.

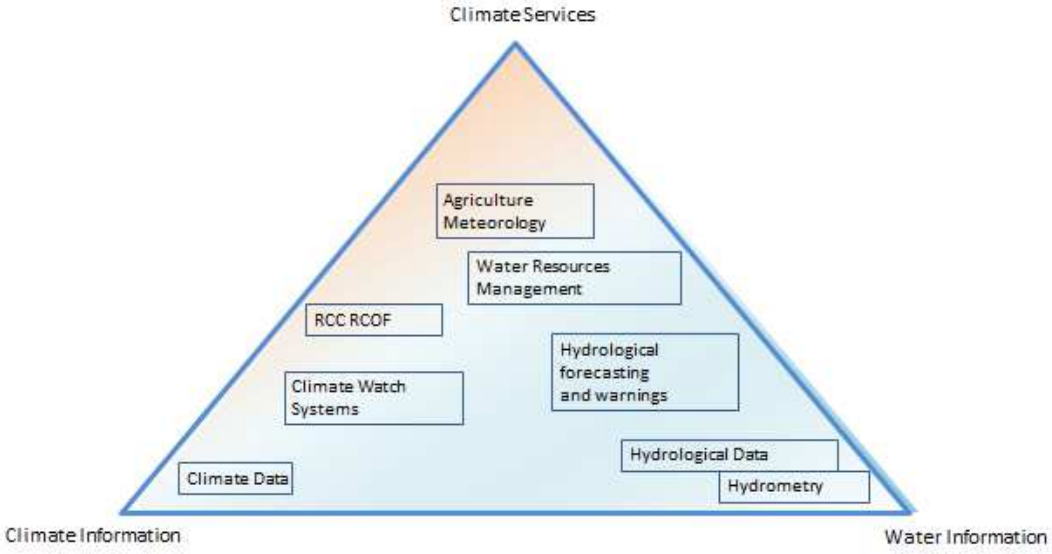


Figure 2.- Tasks Teams integrating the Working Group on Climate and Hydrology represented within a triangle with vertices corresponding to climate information, water information and elaborated climate services.