Report on

SECOND MEDCOF TRAINING WORKSHOP ON

“Verification of Operational Seasonal Forecasts in the Mediterranean region”

November 15-18, 2016

SEVENTH MEDITERRANEAN CLIMATE OUTLOOK FORUM (MedCOF-7)

November 21-23, 2016

CNR, Piazza Aldo Moro 7, Roma, Italy

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Executive Summary

The MedCOF-7 forum was held in Rome from 21 to 23 November 2016 hosted by the National Research Council (CNR) of Italy. The MedCOF-7 forum was held jointly with SEECOF-16 and PRESANORD-10. Previously, the 2nd MedCOF Training Workshop on "Verification of Operational Seasonal Forecasts in the Mediterranean region" was held as a pre-COF activity from 15 to 18 November 2016. The coordination of all events has been essential to distribute tasks and avoid overlaps. The MedCOF-7 forum was mainly focused on the production of the consensus large scale climate outlook for the winter 2016-2017. MedCOF-7 has finally released a large scale seasonal forecast for the whole Mediterranean region which was further refined by sub-regional COFs (PRESANORD and SEECOF) for their respective areas. Following discussions have also allowed agreeing on some topics relevant for the functioning of MedCOF.

1. Introduction.

1.1. Background

Regional Climate Outlook Forums (RCOFs) have been the major component of WMO Climate Information and Prediction Services (CLIPS) project activities and are widely recognized to be key elements in the implementation of GFCS at regional and national scale. First established in 1996 at a Meeting in Victoria Falls, Zimbabwe, RCOFs gained momentum as a regional response to the major 1997–1998 El Niño event, since then RCOF concept was spread worldwide. WMO and a number of national, regional and international organizations (e.g., NOAA, IRI, MeteoFrance, World Bank, etc.) have continuously supported their growth and expansion.

Built into the RCOF process is a regional networking of the climate service providers and user-sector representatives. Participating countries recognize the potential of climate prediction and seasonal forecasting as a powerful development tool to help populations and decision-makers face the challenges posed by climatic variability and change. Regional climate outlooks are based on input from NMHSs, regional institutions, Regional Climate Centers (RCCs), Global Producing Centers of long range forecasts (GPCs) and other climate prediction centers.

The RCOFs generally include pre-COF capacity development for the experts from NMHSs to improve their skills in long range forecasting and communicating the probabilistic information along with the uncertainties. It is followed by the Forum to interpret the available real-time seasonal prediction products from WMO GPCs and WMO RCCs, assess the skills of forecasting systems, develop the consensus seasonal

climate outlook statement for the region, and discuss on the potential applications of RCOF products of the regional and international climate experts to develop a consensus for the regional climate outlook, typically in a probabilistic form. The RCOFs are widely recognized to be one of the key elements of GFCS implementation at regional level. The RCOFs then lead to national forums (NCOFs, NCFs) to downscale RCOF products and develop detailed national-scale climate outlooks and risk information including warnings for communication to decision-makers and the public.

Following the recommendations given by RA VI Task Team on RCOF and supported by the RA VI Working Group on Climate and Hydrology targeting South Western Europe/ Mediterranean basin as suitable for a RCOF implementation and considering the recommendation by the Scoping Workshop on Seasonal Climate Prediction (Algeria, January 2012) of extending the existing RA I PRESANORD to the whole Mediterranean area involving thus RA I and RA VI;

AEMET jointly with WMO -and after conversations with many parties- convened a Scoping Meeting (SC) at AEMET headquarters in Madrid from 12 to 14 June 2013 to define the features and objectives of a future Regional Climate Outlook Forum encompassing among others National and Regional Services around the whole Mediterranean region. The first formal MedCOF meeting was held in Belgrade, Serbia, 18-19 November jointly with SEECOF-10.

The Mediterranean Climate Outlook Forum (MedCOF) covers the whole Mediterranean region, cutting across the two WMO Regional Associations (RAVI and RAI). MedCOF is aimed at developing consensus based seasonal outlook for the entire Mediterranean region, strengthening the NMHSs existing capabilities in seasonal forecasting, and promoting inter-regional cooperation and partnership. It has been agreed by the 34 participating countries that MedCOF will operate as an overarching entity in support of the South-East European Climate Outlook Forum (SEECOF) and the forum of Prévisions Climatiques Saisonnières en Afrique du Nord (PRESANORD). Therefore, it is a reasonable approach that these three RCOFs be organized together, starting with 1 day of

MedCOF session, followed by 1 day of parallel sessions for SEECOF and PRESANORD and MedCOF plenary and 1 final day of a joint session with stakeholders and users

The MedCOF3 (November 2014) plenary decided that training activities -usually organized as a pre-COF session- were separated from the more operational Forum sessions aiming at developing a consensus for the regional climate outlook in order to avoid excessively long MedCOF events which may interfere with domestic responsibilities. However, the MedCOF Management Group decided to organize jointly with MedCOF-7 a pre-COF training activity benefiting from the fact that the host institution is also the RA VI Training Centre

Therefore under the guidance of the MedCOF Management, the 2nd MedCOF Training Workshop on "Verification of Operational Seasonal Forecasts in the Mediterranean region" was held as a pre-COF activity from 15 to 18 November 2016, in Rome, Italy. The 2nd MedCOF Training Workshop brought together experts from NMHSs of the Mediterranean region and from WMO GPCs, designated RCCs and other relevant scientific institutions. The Training Workshop comprised two steps: one distance learning module followed by a one face-to-face 4 days long course including key note lectures and hands-on training. According to the foundational MedCOF agreement, this Training Workshop pointed to strengthen the NMHSs existing capabilities in seasonal forecasting, and to promote inter-regional cooperation and partnership.

MedCOF-7 is composed as usual of 3 steps; the first one will be devoted to verification of the MedCOF-6 summer forecast; the second one to the assessment of current state of climate and, finally, the third one to the building of consensus statements.

Funding for this initiative comes from USAID through WMO and AEMET through the ACMAD Trust Fund established in WMO for the North African participants and from the Italian hosts (CMCC, CNR-IBIMET, Aeronautica Militare)

1.2 Date and Venue

Following the kind invitation of the National Research Council (CNR) of Italy, the Second MedCOF Training Workshop on Seasonal Forecasting, 7th session of the Mediterranean Climate Outlook Forum (MedCOF 7), 16th session of the South East European Climate Outlook Forum (SEECOF 16) and 10th session of the Northern African Climate Outlook Forum (PRESANORD 10) were held from 15 to 23 November 2016 in Rome, Italy.

The meeting venue was the headquarters of National Research Council of Italy, Piazzale Aldo Moro, 7 00185 Rome, Italy (more details on local arrangements in http://medcof.aemet.es/images/doc_events/medcof7/docMedcof7/Information%20note%20-%20RTC%20MedCOF_November2016_Final.pdf).

1.3 Participants

MedCOF brought together representatives from all countries involved in South Eastern Europe Climate Outlook Forum (SEECOF): Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Georgia, Greece, Hungary, Israel, Moldova, Montenegro, the Former Yugoslav Republic of Macedonia, Romania, Serbia, Slovenia, Turkey, Ukraine; and in North African Climate Outlook Forum (PRESANORD): Morocco, Algeria, Tunisia, Libya and Egypt; as well as France, Italy, Spain, Portugal, Jordan, Lebanon, Malta, Mauritania and Syria. Resource persons from Meteo France, CPTEC-INPE, ECMWF, DWD, Roshydromet, AEMET, as well as representatives from WMO have attended MedCOF. Some resource persons were attending either to the pre-COF Second MedCOF Training Workshop on Seasonal Forecasting or to the RCOF sessions (MedCOF 7, SEECOF 16, PRESANORD 10) or both. Most climate experts were invited to attend all consecutive events. A list of participants is available in Annex III.

1.4 Programme

The MedCOF-7 forum (jointly with SEECOF-16 and PRESANORD-10) was held in Rome from 21 to 23 November 2016 hosted by the National Research Council (CNR) of Italy. Previously, the 2nd MedCOF Training Workshop on "Verification of Operational Seasonal Forecasts in the Mediterranean region" was held as a pre-COF activity from 15 to 18 November 2016.

The pre-COF Training Workshop started on Tuesday 15 November. Marina Baldi (Head of the RAVI Training Centre, IBIMET-CNR) welcomed the participants and made a short introduction of CNR activities. Then, Ernesto Rodriguez (AEMET) presented the objective and format of the training workshop mainly consisting of a balance between lectures and practical sessions. Finally, Silvio Cau (Head of the Servizio Meteorologico dell'Aereonautica Militare (SMAM) and PR of Italy) made a recollection of the activities of the SMAM relevant to MedCOF. The annex I summarizes the programme of the Training Workshop. All presentations and working material are available in http://medcof.aemet.es/index.php/events/training2/training2-programme

The 7th session of the Mediterranean Climate Outlook Forum (MedCOF 7), 16th session of the South East European Climate Outlook Forum (SEECOF 16) and 10th session of the Northern African Climate Outlook Forum (PRESANORD 10) were held from 21 to 23 November 2016. MedCOF-7 was designed in a way to accommodate five sessions:

Opening Session
Session I – Verification
Session II – Climate monitoring
Session III – Production of large scale climate outlook for winter (DJF) 2016-2017
Session IV - Discussion on MedCOF matters
Session V - Joint session with users and stakeholders

The formal opening session started on Monday 21 November with speeches from Massimiliano Di Bitetto (CNR), Anahit Hovsepyan (WMO), Natalia Berghi (WMO RA VI) and Silvio Cau (Servizio Meteorologico dell'Aereonautica Militare).

Natalia Berghi on behalf of the Regional Office for Europe and the WMO Representative for Europe delivered a key message starting by thanking and acknowledging the contributors to the implementation of the RA VI Strategic Plan. She mentioned the Paris Agreement as a breakthrough influencing the climate agenda and made a recall of other relevant achievements. Among others she cited: the GFCS Implementation Plan; Resolution 60 (Cg-XVII); Initial Compendium of the GFCS projects; The WMO Strategy for Service Delivery; Accreditation to the Green Climate Fund; The RA VI RCC Network; Sustainability of RCOFs in RA VI; A single web portal for all RCC products; The Climate Watch System; Provision of the Climate Watch Advisories… She also recalled the main challenges citing: i) Quality Control & Quality Management System; ii) Monitoring and evaluation of Climate Services Impact; iii) Mapping of Ongoing Climate Service Initiatives in Europe; iv) Linking Climate Knowledge to Action for Resilience; v) Communication of climate services. Finally, she made a recollection of proposals and recommendations for follow-up and future activities. Among others, she mentioned the following points: i) Support the process for the National Adaptation Plans formulation and implementation; ii) Establishment of climate information systems; iii) Implementation of the Quality Policy; iv) Establishment of the User-Interface Mechanisms, v) Development of users communication strategies, vi) Development and implementation of projects on climate services; vii) Implementation of the Regional/National frameworks for climate services; viii) Make best use of the existing regional and national bodies and establish new, as necessary, to: 1) deliberate on the NMHSs and user requirements in connection to climate services, as well as to: 2) draft project proposals and 3) strive to secure funding in cooperation with different development partners.

Session I focused on verification of the previous summer 2016 seasonal forecasts. Session II provided climate monitoring information whereas session III were devoted to the production of the climate outlook for winter 2016-2017. In these sessions all inputs received from the Global Producing Centers, the Regional Climate Centers and the climate experts of the Mediterranean countries were presented and discussed. Finally, session IV was devoted to discussions on MedCOF matters, as well as to summarize a list of conclusions. Annex II summarizes the programme of MedCOF-7. All presentations and working material are available in http://medcof.aemet.es/images/doc_events/medcof7/docMedcof7/Programme_MedCOF7.pdf

1.5 Working Language

The working language of the meeting was English.

2. Development of the MedCOF-7 meeting

2.1 Session I: Verification of MedCOF-6 summer seasonal forecast

The first intervention on "*Verification of MedCOF-6*" was presented jointly by Peter Bissolli (DWD, Germany) and Hanene Mairech (INM, Tunisia). The previously prepared verification document was discussed, amended and finally approved.

For temperature over Europe/RA VI, the MedCOF-6 outlook favored the warm scenario in Region 2 and 3, which cover almost the whole RA VI part. It was mainly correct for these two regions. A few places, which were in the middle or (very exceptional) in the lower tercile occurred either very locally or/and could not supported by data. For Region I (the westernmost part of the RA VI MedCOF region), no privileged scenario could be

given by MedCOF-6. According to the analysis data, temperature in this region was normal to above normal (middle or upper tercile), the majority in the upper tercile. Since climatology was assumed for no privileged scenario, the result of the MedCOF-6 outlook was mostly not correct or not applicable. The main reason was a circulation change during the summer season, which could not be resolved on seasonal average and hence caused uncertainty.

For temperature over North Africa (RA I), the MedCOF-6 climate outlook for the 2016 summer season favored an above-normal temperature over the entire North African domain except the western region where no clear signal was detected. Probability for the upper tercile over eastern regions (including Egypt, Libya and the southeast of Algeria) was 60%. Over the remaining regions (including Tunisia and Algeria) the probability for the upper tercile was 40%. In fact, in almost all regions of North Africa, temperature anomalies were normal to above normal except Morocco and Egypt where conditions were in the above-normal tercile. This indicates that the MedCOF-6 climate outlook for the summer season temperature was able to predict temperature anomalies registered for most of North African regions except the western region where no scenario was specified.

For precipitation over Europe/RA VI, the MedCOF-6 outlook favored a drier-than-normal summer (lowest tercile) in the southwest of the RA VI part of the MedCOF region (Iberia and western Mediterranean). This was mainly correct. In a few places, precipitation was only slightly below normal and therefore in the middle tercile. For the rest of the RA VI part, no privileged scenario could be given by MedCOF-6. The above-normal precipitation systems over Italy / West Balkans, Hungary/Romania, eastern Ukraine and northeast Turkey / western Georgia and the drier areas in between could not be resolved by the outlook.

For precipitation over North Africa (RAI), a drier-than-normal signal was favored over western regions with a probability of 45% for the below-normal tercile. Elsewhere, there was no preference for any climate defined categories. Summer 2016 was wetter than

normal over the south of Tunisia, north-western regions of Libya, the central east and the South of Algeria. In Morocco precipitations were in the normal to above normal category. Elsewhere precipitations were below normal. MedCOF-6 precipitation prediction didn't give any valuable information.

2.2 Session II: Climate monitoring

Peter Bissolli (DWD, Germany) and Hanene Mairech (INM, Tunisia) presented the MedCOF-7 climate monitoring draft.

The oceanic analysis shows that along the Equator and due to SST cooling in the eastern part, the surface anomaly now extends from the Peru coast to the dateline. In the Nino3.4 box, the monthly anomaly mean is now just below -0.5°C, threshold of "La Niña". This cold anomaly can also be seen in the sub-surface. West of the dateline and around the Maritime Continent, there are still positive anomalies despite of a cooling trend in October. On the North Pacific, the positive PDO pattern, which was still quite remarkable in summer 2016, has weakened until October. According to SST distribution, the positive pattern can still be seen (cold anomaly in the interior of the basin, warm anomaly at the Pacific coasts), but the indices for October are either negative (NOAA: 0.9) or at least smaller than in spring/summer 2016 (+0.56). In the Indian Ocean: weakening of the east (positive anomalies) - west (neutral) contrast ==> DMI remains positive, but less intense than in September. The cold anomaly on the North Atlantic (cold blob) still exists, but over the East Atlantic close to Europe, SST is normal to above normal. The whole Mediterranean basin is 1-2°C warmer than normal, the Black Sea mostly colder. The tropical and equatorial Atlantic up to the Caribbean Sea is still warmer than normal. The polar and arctic region (north of 60°N), in Europe in particular, is extremely warm.

With regard to the atmospheric analysis, the velocity potential anomaly field in the high troposphere shows as the most remarkable feature in the tropics a dipole with a large

upward motion anomaly over Indonesia, due to Madden-Julian Oscillation (MJO) and a large downward motion anomaly over the western Indian Ocean, linked to a negative DMI (Dipole Mode Index). Over the eastern equatorial Pacific there is still a week positive anomaly (downward motion anomaly), consistent with La Nina. SOI (from NOAA CPC) decreased to -0.3, which would mean no significant Southern Oscillation. The stream function anomalies in the high troposphere do not reveal any teleconnections from the tropics to the MedCOF region, neither from the western Indian Ocean nor from the La Nina region.

With respect to geopotential height at 500 hPa and sea level pressure over Europe, an outstandingly large positive geopotential anomaly over the whole European Arctic region stands for large-reaching high pressure conditions over that area and thus a considerable weakening of the polar vortex (POLEUR Index = -2.9, Table 1). The high pressure area also extended to Scandinavia and even to West Russia, inducing also a positive Scandinavia pattern (SCAND=1.1) and a negative East Atlantic – West Russia pattern (EATL/WRUS= 1.3). Blocking conditions, which were already to be seen in August 2016, increased further, and Scandinavian Blocking became the dominant pattern for Europe in October 2016. The NAO index is still positive at +1 (source NOAA (ftp://ftp.cpc.ncep.noaa.gov/wd52dg/data/indices/tele_index.nh), but only active over the western North Atlantic, persistent but relatively weak with little effect for Europe. The East Atlantic pattern weakened in October (EA=0.4 only), due to extending blocking High conditions even over UK/Ireland. The weakening of the polar vortex also supports the air mass exchange between polar and middle latitudes, which induces a negative phase of the Arctic Oscillation (AO); it was outstandingly intense throughout the month of October 2016. The blocking high was also extremely intense on sea level (Figure 8). New daily records of surface pressure (>1050hPa) were measured in Norway and Sweden. Although a westerly flow was still present over the eastern North Atlantic (due to a more intense Icelandic Low), this flow was redirected to the polar latitudes west of the blocking High, thus mild air masses reached the Arctic region, weakening the polar vortex further. On the other hand, relatively cold continental air masses from central Asia flowed to Europe. High pressure influence affected also the MedCOF region, particularly

the north and decreasing to the south. The Mediterranean itself and northern Africa were still influenced by subtropical air masses.

Over Europe, monthly mean temperature in October 2016 ranged from less than 5°C in highlands to above 25°C in southern Israel. Northern parts of the region from France to South Caucasus were all colder than normal (1981-2010 reference), locally more than 2°C colder, and in the lowest tercile. Iberia and the Mediterranean including southern Italy, southern Balkans, Turkey and Middle East were mainly warmer than normal and in the upper tercile, with highest anomalies over southwestern Turkey at more than +2°C (for 1961-1990 reference even more than +3°C). Over North Africa, during the month of October 2016, registered temperatures were above normal over almost all of North African Domain. The anomaly has reached more than +4°C especially in the eastern regions of Libya. Some records have been noticed at several stations. Southern regions of North African domain have registered normal to below normal temperature.

Over Europe, monthly precipitation totals in October 2016 over the RA VI domain of the MedCOF region ranged from 0mm in eastern Syria and northeastern Jordan to more than 200mm at the west Balkans coast and eastern Black Sea coast. Some locally heavy precipitation fell also in northeastern Portugal, southern Spain, southern France, Italy, northeastern Romania/Moldavia/western Ukraine, and Azerbaijan. Remarkably, an extreme rain event also occurred in southern Israel / southern Jordan at the end of the month. It was wetter than normal over almost the whole Balkan Peninsula and also further north up to Hungary and Ukraine. In northeastern Romania up to more than 500% of the normal precipitation fell. Other wetter-than-normal areas were the eastern South Caucasus / eastern Turkey, and more locally in Spain, southern France, Italy and southern Israel/Jordan. Particularly drier than normal were regions at the Atlantic coasts (Portugal, northern Spain, western France), parts of Italy and Corsica, most of Turkey and the Middle East.

Over North Africa, during the month of October 2016, most of the North African region had known below-normal totals of precipitation. The south of Morocco, central west Algeria, the center of Egypt and the southeast of Libya had normal to above normal precipitation. A wet cell in the center east of Egypt is noticeable. Mediterranean North African coastlines had near normal to below normal precipitation. Most parts of the Sahara, which is known as a dry zone, were even drier during this month of the year.

The previously prepared monitoring document using information from the corresponding RA VI and RAI RCCs was discussed, amended and finally approved.

2.3 Session III: Production of large scale climate outlook for winter (DJF) 2016-2017.

The Session III started with the presentation by Roxana Bojariou (Romanian Met Service) on "*Climate predictive drivers for the Mediterranean region*". She made made an observational analyses of large scale drivers for winter predictability over the Mediterranean region, namely: SSTs (Tropical, North Atlantic and Decadal Variability), snow cover, Arctic sea ice, lower stratosphere and other factors such as global warming. El Niño will likely be in a weak negative phase. La Niña is slightly favored to persist (~55% chance) through winter 2016-17. Reduced cold blob in 2016 compared to 2015 with possible effects on the jet stream position in the Atlantic-European area. Impact on winter conditions over Europe? She noted the contrast in temperature anomalies in Siberia (very cold) and Arctic (very warm) which could influence the jet stream position in the NH. The extended snow cover over the Southern Siberia seems consistent with the negative AO/NAO. The negative anomalies in the ice extent over Arctic regions are usualy related with atmospheric blockings over Europe and Asia.

Damien Decremer (ECMWF) presented “Seasonal forecast from System 4” for DJF 2016/2017. The Icelandic high with low pressure over Azores (AO- & NAO-) tend to show weakened polar vortex with more flow exchanges between Arctic and Europe. Weaker westerlies traversing the North-Atlantic will bring Jetstream southward to give higher storm incidence over South-Europe. This translate in more than normal precipitation in Mediterranean region and slight warm anomaly over northern Europe and south of Caucasus. He also presented the plans and requests for System 5. They include higher atmospheric horizontal resolution ($T_{CO}639$ L91), increased hindcast ensemble size to 25, 0.25° Z75 Ocean (Nemo 3.4.1) and improvements in atmosphere and land surface (LIM2 sea-ice model, new ozone scheme (Monge-Sanz 2011 doi: 10.5194/acp-11-1227-2011), accuracy of ENSO similar, but will have better QBO, improved land surface initialisation: LAI, soil moisture, lakes, etc. It will be operational early 2017.

Valentina Khan (Roshydromet, Russia), as representative of GPC Moscow, presented the seasonal forecast from Roshydromet with some examples of outcomes relevant for MEDCOF. After introducing brief information about RHMC and the processing for seasonal forecasts at GPC-Moscow and NEACC, she summarized that: a) according to the forecasts of the most of the models the negative anomalies of SST are expected in the central part of the Pacific Ocean through the winter 2016-2017. The probabilities for La Nina, neutral and El Nino conditions (using -0.5C and 0.5C thresholds) over the coming DJF season are: 47%, 51% и 2 %; b) Most of the centers predict significant SST anomalies in the North Pacific Ocean connected with the positive phase of PDO. It can drive the variations of the geographical position and intensity of the Pacific maximum and the Aleutian minimum. The significant temperature and precipitation anomalies are possible in the Far East as a result; c) In the North Atlantic significant positive SST anomalies are expected near the Gulf Stream and NEZ. The negative anomalies are expected from Labrador to Europe. The forecasts of most centers indicate the signal associated with the appearance of positive SST anomalies in the Norwegian and Barents Seas; d) GPC-Moscow predicts the negative phases of EA in winter 2016-2017. The negative phase of EA is associated with the positive temperature anomalies in Europe. The positive anomalies of precipitation are possible in the west of Europe; e) The winter

season of 2016-2017 is expected warmer than normal over most of Mediterranean region according to the forecasts of the most of models; f) There are a lot of contradictions and uncertainties in the forecasts of precipitation. The precise signal is marked only in the south-east of Europe where below normal precipitation is expected.

Jean-Michel Soubeyroux (Météo France), as representative of GPC Toulouse, presented the new version of Arpege System 5 model which has already replaced the system 4 for operational production and MF contribution in EUROSIP Multimodel: main upgrades (resolutions, coupled models), skills and some examples of outcomes relevant for MEDCOF. The current version of Arpege System 5 is operational since September 2015 with hindcast (1991-2014); integration in EUROSIP in May 2016. It includes significant improvement vs Arpège S4 such as doubling horizontal resolution (and time step) (t127 → t255 (75 km)); tripling the vertical resolution (31levels → 91levels); new coupled modules (sea-ice component (GELATO model), surface model (SURFEX model)) and stratosphere (ozone, gravity waves), new ocean analyses/reanalyses by Mercator-Ocean (NEMO 1°). Hincast : 15 members, Forecast : 51 members. Stochastic perturbations to the dynamics equations.

Silvio Gualdi (CMCC, Italy) presented the seasonal forecast from CMCC for winter 2016-17 over the MedCOF domain.

Massimiliano Pasqui (IBIMET, Italy) presented the seasonal forecast from statistical systems. He presented first the SPECS empirical forecast for DJF 2016/2017 and then the IBIMET forecasts based on a linear multi-regressive method based on physical atmospheric indices and sea surface anomalies. From IBIMET he showed that a coherent signal of lower than normal temperature is present over a large part spanning from Central to Western Europe and Central to Western Mediterranean basin.

Christian Viel (Météo France) presented the “Summary from RA VI RCC-LRF”. He summarized that the weak La Niña event now established in the tropical Pacific Ocean seems to be maintained during the remainder of fall, persisting through mid-winter, then

weakening to cool-neutral by later winter. The long lasting North Atlantic cold blob over a large area to the south of Greenland shows some weakening trend. Although tropical ocean forcing is relatively weak, possible teleconnections from North Atlantic tropics suggest some perspective of anomalous cyclonic circulation over Southern Europe consistent with a negative phase of NAO. Finally, a significant number of GPC models shows as common feature some slight predominance of a positive phase for EA and SCAN patterns of variability and also climate drivers tend to point to an enhance occurrence of negative NAO.

Badi Wafae (DMN, Morocco) presented the "Summary from North African RCC-LRF". She explained that seasonal forecast for DJF2015/2016 from RCC-North Africa was based on known teleconnections of large and regional patterns (ENSO+PDO, QBO, NAO, TNA), and on dynamical and statistical models. A strong El Niño continued during November as indicated by well above-average sea surface temperatures (SST) across the central and eastern equatorial Pacific Ocean. Most models indicate that a strong El Niño will continue through the Northern Hemisphere winter 2015-16. El Niño has already produced significant global impacts and it is expected to affect positively temperature anomalies in most regions over North Africa. These conditions associated with warm phase of PDO can drive NAO+ over the north Atlantic region. The QBO is currently in the westerly phase favouring also NAO+ over the region with the consequent reduction of precipitation over North Africa. SST patterns in the Tropical Northern Atlantic may offer some predictability for this winter, especially over Morocco, due to the anomalously warm water in the tropical region. As a summary of all information analyzed by RCC-North Africa for DJF 2015/16: i) precipitation can probably be near to below average over northern and along coastal part of southern Morocco, below average over most of Algeria, Libya, Tunisia and Egypt and near to below average over southeastern Libya and southern Egypt; ii) temperature can probably be above average over Morocco, Tunisia, most of Algeria and western Libya and near to above average over southern Algeria, eastern and southern Libya and Egypt.

After the general presentations in Session III, Christian Viel and Badi Wafae made an initial proposal of seasonal forecast compiling all relevant sources of information. Then vivid discussions took place and after the group split into two groups for the independent work of sub-seasonal RCOFs, SEECOF and PRESANORD. Both groups worked in parallel sessions and at the end proposed some consensus seasonal forecasts for their respective sub-regions. The final joint plenary resumed discussions and a final consensus seasonal forecasts was produced for the whole MedCOF domain (see Annex IV). The MedCOF consensus seasonal forecast is coherent with the more detailed solutions proposed by SEECOF and PRESANORD for their respective regions.

2.4 Session IV: Discussion on MedCOF matters

The 4th session of MedCOF-7 chaired by Ernesto Rodriguez (AEMET) covered the following proposed topics:

- Elections.
- Verification: proposal of domains for verification of seasonal forecasts RCC RAVI
- Thresholds for dry season
- Futures training activities: When? Where? Topic?
- Next MedCOF-9
- Way forward
- AOB

Elections.

According to the MG ToR approved by MedCOF5, “the MT will elect a chair and a vice-chair, each for an alternating two-year period, one year the chair is to be elected for

2 years, and next year the vice-chair for 2 years, to ensure regional balance and an optimum of experience transfer. Reelection can be envisaged". The plenary took note and approved that the current vice-chair (Fatima Driouech) will be elected as MG chair in MedCOF9 (Nov 2017).

Verification.

Jean-Michel Soubeyroux made a proposal of domains within the MedCOF area for verification of seasonal forecasts by RCC RAVI. After some discussion and amendments to the initial proposal, it was finally agreed that the last version of the verification domains would be refined and approved by the MG.

Thresholds for dry season

As approved in MedCOF5, the working group with affected Northern African countries will make a proposal to be presented in MedCOF9 of suitable thresholds for masking maps of precipitation during dry season.

Futures training activities

It was discussed and decided to repeat the same format consisting of preCOF training (4 days) followed by parallel operational MedCOF/SEECOF/PRESANORD (3 days) including interaction with users. Following the survey among the focal points, it was agreed that the next training workshop will be focused on "sources of predictability for the Mediterranean region"

Next MedCOF-9

Tentatively it was agreed to conduct the next face-to-face sessions in November 2017, in Croatia, subject to formal confirmation by the host Institution.

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2.5 Session V: Joint session with users and stakeholders

One important aspect of the Forums in general, and of MedCOF in particular, is the facility to bring together experts in various fields and end users of forecasts in an environment that encourages interaction and learning. The joint session with users and stakeholders allowed to cover a wide variety of sectors sensitive to climate conditions (see Annex II including the presentations by users). The representatives of the different sectors focused their respective interventions on some proposed issues relevant for MedCOF:

• Current use of climatological information based on observations,
• Which time scales (from monthly to decadal) are more critical in your activity?
• Current use of climate predictions in different time scales (from montly up to decadal).
• Are you (your sector) familiarized with the use and explotation of probabilistic forecasts?
• What is the main reason hampering the use of climate predictions in your sector? (not enough information, lack of skill, difficult access to data, etc)

The joint session with users concluded with a round table which can be summarized with the following bullets:

- Speak the same language: need to agree on terminology and basic concepts to diminish communication barriers.
- Forecasts at seasonal scale are essentially probabilistic and they should never be presented as deterministic to facilitate user's understanding. The use of analogies with other processes essentially probabilistic (e.g., roulette, dice playing, etc.) may also help in the communication process.
- Need to communicate uncertainty of seasonal predictions, better using positive language, e.g., speaking in terms of degree of certainty and confidence.
- Due to the high proliferation of information on seasonal forecasts easily accessible through internet, there is a clear need of reliable and authoritative sources of information.

- Relevant climatic and user tailored variables may change with different time scales from monthly to decadal.
- Interdisciplinary approaches and procedures should dominate the relation between providers and users of climatic information.
- The different categories of users and audiences were widely recognized. Each of them has different degree of expertise and different needs for their applications and decision making processes. In particular, highly specialized users should have specific products targeted to their decision making processes.
- RCOFs were recognized as a very useful platform for knowledge transfer and for facilitating access of NMHSs –particularly the small ones- to authoritative information.
- Although the main recipients of RCOF information are the NMHSs -and so they were conceived almost twenty years ago when they were created-, most participants expressed their support for a production of different levels of products, enriching the RCOF outcomes.
- As possibly many users are expecting too many products from RCOFs in terms of differentiated outcomes, it was reminded that original RCOF concept and their achievements will be reviewed next year by WMO. As a result of this review process probably will arise the need to rethink procedures and objectives.
- It was also suggested and recommended that RCOFs, with their privileged position as bridge between NMHSs and users, may convey certain needs to projects and big data providers.

Both technical and financial support was unanimously acknowledged by participants without whom this meeting would have not been possible. The meeting end up with a round of applause from everyone for Marina Baldi and Vieri Tarquiani in representation of the host institution in recognition of the perfect arrangements which have allowed a very pleasant, efficient and fruitful meeting.

2.5 Session V: Conclusions

• The verification and monitoring documents have been discussed and approved by the participants.
• The consensus-based climate outlook for winter 2016/2017 has been produced.
• In the discussion session on MedCOF issues a number of actions were agreed:

- The plenary approved that the current vice-chair (Fatima Driouech) will be elected as MG chair in MedCOF9 (Nov 2017).
- The domains within the MedCOF area for verification and other products from RCC RAVI will be refined and approved by the MG.
- The working group, with concerned Northern African countries, on thresholds for dry season will make a proposal to be presented in MedCOF9
- It was discussed and decided to repeat the same format consisting of preCOF training (4 days) followed by parallel operational MedCOF/SEECOF/PRESANORD (3 days) including interaction with users. Following the survey among the focal points, it was agreed that the next training workshop will be focused on "sources of predictability for the Mediterranean region"
- Tentatively it was agreed to conduct the next face-to-face sessions in November 2017, in Croatia, subject to formal confirmation by the host Institution.

- The joint session with users concluded with a list of recommendations (see Sec. 2.5)

Annex I

Second MedCOF Training Workshop on

Verification of Operational Seasonal Forecasts in the Mediterranean region

CNR, Digital Library, Piazza Aldo Moro 7, Roma, Italy

Programme

	Day 1: Tuesday 15th November 2016
08:30	**Participants registration**
09:00	**Opening Session** • Marina Baldi, IBIMET RTC • Antonio Raschi, IBIMET-CNR • Ernesto Rodriguez Camino, AEMET • Silvio Cau, Servizio Meteorologico dell'Aereonautica Militare
10:00	• J.P. Ceron: "Verification of seasonal forecasts: what for?"
11:00	**Coffee Break**

11:30	• J.P. Ceron: "Verification of seasonal forecasts: review of concepts" • E. Di Giuseppe: "Introduction to open source R"
13:30	**Lunch**
15:00	• J. P. Ceron: "Exercises on use of probabilistic forecasts, ROC areas and reliability" (Practical Session)
16:30	**Coffee Break**
17:00	• J. P. Ceron: "Exercises on use of probabilistic forecasts, ROC areas and reliability" (Practical Session)

	Day 2: Wednesday 16th November 2016
09:00	• J.P Ceron: "Predictability, uncertainty in relationship with probabilistic forecasts" • P. Athanasiadis: "Metrics and diagnostics for seasonal forecasts evaluation"
11:00	**Coffee Break**
11:30	• M. Pasqui: "Downscaling techniques: do they always improve seasonal forecasts?"
12:30	• E. Di Giuseppe: "Data analysis and manipulation with open source R tool " (Practical Session)
13:30	**Lunch**
15:00	• E. Di Giuseppe: "Data analysis and manipulation with open source R tool " (Practical Session)
16:30	**Coffee Break**

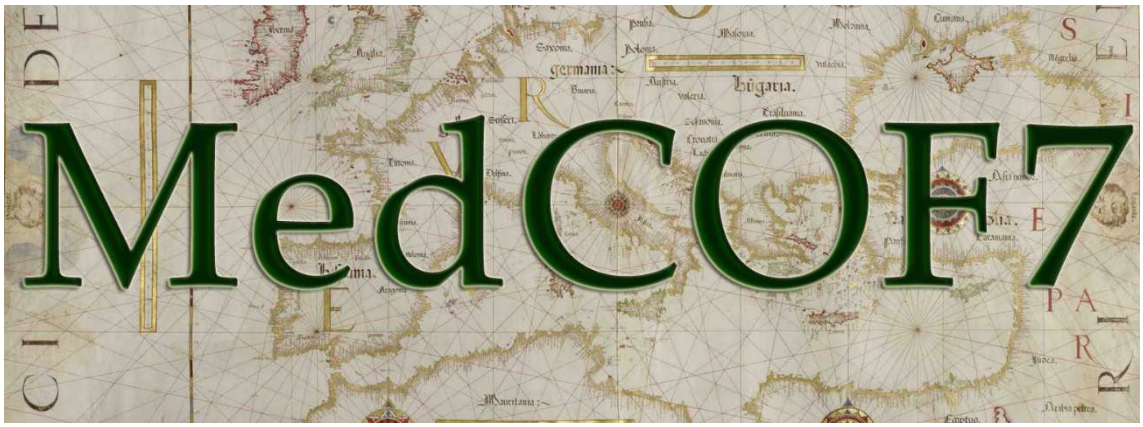
17:00	• E. Di Giuseppe: "Data analysis and manipulation with open source R tool " (Practical Session)

	Day 3: Thursday 17th November 2016
09:00	• E. Rodríguez: "Verification of seasonal forecasts for sectoral variables" • S. Gualdi: "Diagnostics for physical evaluation of seasonal models"
11:00	**Coffee Break**
11:30	• C. Coelho: "Introduction to the R Forecast Verification Package"
12:30	• C. Coelho: "Hands-on session using R Forecast Verification Package: a) unconditional biases and hits; b) scoring probabilistic forecasts" (Practical Session)
13:30	**Lunch**
15:00	• C. Coelho: "Hands-on session using R Forecast Verification Package: a) unconditional biases and hits; b) scoring probabilistic forecasts" (Practical Session)
16:30	**Coffee Break**
17:00	• C. Coelho: "Hands-on session using R Forecast Verification Package: a) unconditional biases and hits; b) scoring probabilistic forecasts" (Practical Session)

	Day 4: Friday 18th November 2016
09:00	• C. Coelho: "Hybrid (empirical-dynamical) EUROBRISA forecasting system" • S. Materia: "Diagnostics for physical evaluation of seasonal models over the Mediterranean region"
11:00	**Coffee Break**
11:30	• C. Coelho: "Hands-on session using R Forecast Verification Package: a) reliability and resolution; b) ROC diagrams" (Practical Session)
13:30	**Lunch**
15:00	• C. Coelho: "Hands-on session using R Forecast Verification Package: a) reliability and resolution; b) ROC diagrams" (Practical Session) • P. Bissolli: "Verification of MedCOF consensus forecasts"
16:30	**Coffee Break**
17:00	• Training Course Evaluation • Training Course Closure

Annex II

SEVENTH MEDITERRANEAN CLIMATE OUTLOOK FORUM



November 21-23, 2016

Rome, Italy

Programme

Monday 21 November

Sala Marconi, CNR Headquarters, Piazza Aldo Moro 7, Rome

08:30 – 09:00 **Registration**

09:00 – 09:30 **Opening**

- Massimiliano Di Bitetto (CNR)
- Anahit Hovsepyan (WMO)

- Natalia Berghi (WMO RA VI)
- Silvio Cau (Servizio Meteorologico dell'Aereonautica Militare)

09:30 – 10:30 Session I – Verification of MedCOF-6

- Peter Bissolli (DWD, Germany) and Hanene Mairech (INM, Tunisia): Presentation of MedCOF-6 verification draft.
- Discussion and approval of step 1 document

10:30 – 11:00 Coffee break/group photo

11:00 – 12:30 Session II – Climate monitoring

- Peter Bissolli (DWD, Germany) and Hanene Mairech (INM, Tunisia): Presentation of MedCOF-7 climate monitoring draft.
- Discussion and approval of step 2 document.

12:30 – 14:00 Session III - Production of large scale climate outlook for winter (DJF) 2016-2017

- Roxana Bojariu (NMA, Romania): Climate predictive drivers for the Mediterranean region
- Damien Decremer (ECMWF, UK): Seasonal forecast from ECMWF S4
- Valentina Khan (Hydrometeorological Research Center, Russia): Seasonal forecast from GPC Moscow.
- Jean-Michel Soubeyroux (Meteo-France, France): Seasonal forecast from ARPEGE S5
- Silvio Gualdi (CMCC, Italy): Seasonal forecast from CMCC

14:00 – 15:00 Lunch

15:00 – 16:00 Session III - Production of large scale climate outlook for winter (DJF) 2016-2017

- Massimiliano Pasqui (IBIMET, Italy) Seasonal forecast from statistical systems
- Christian Viel (Meteo-France, France): Summary from RA VI RCC-LRF
- Wafae Badi (DMN, Morocco): Summary from North African RCC-LRF

16:00 – 16:30 Coffee break

16:30 – 18:00 Session III - Production of large scale climate outlook for winter (DJF) 2016-2017 (Chair: C. Viel/W. Badi) (cont.)

- Discussion
- Editing and provisional MedCOF-7 climate outlook statement (step 3 document)

18:00 Adjourn day 1

Tuesday, 22 November

Sala Marconi, CNR Headquarters, Piazza Aldo Moro 7, Rome

09:00 – 11:00 **Parallel sessions SEECOF-16 and PRESANORD-11**

11:00 – 11:30 **Coffee break**

11:30 – 14:00 **Parallel sessions SEECOF-16 and PRESANORD-11**

14:00 – 15:00 **Lunch**

15:00 – 16:00 **Session IV - Discussion on MedCOF matters**

16:00 – 16:30 **Coffee break**

16:30 – 18:00 **Session III - Production of large scale climate outlook for winter (DJF) 2016-2017 (Chair: C. Viel/W. Badi) (cont.)**

- Discussion
- Final approval of MedCOF-7 climate outlook statement (step 3 document)

18:00 **Adjourn day 2**

Wednesday, 23 November

CNR, Via dei Taurini 19, Roma

09:00 – 11:00 Session V – Joint session with users and stakeholders

- Presentation of MedCOF7 climate outlook statement
- Perspectives on Seasonal Forecasting: Anahit Hovsepyan (WMO), Ernesto Rodriguez Camino (AEMET), Roberto Tajani (CNMCA), Silvio Gualdi (CMCC), Bernardo Gozzini (LaMMA, Regione Toscana), Raffaele Salerno (Centro Epson Meteo).

11:00 – 11:30 Coffee break

11:30 – 13:30 Session V (cont.) – Joint session with users and stakeholders

- Valentina Pavan (ARPA Emilia Romagna)
- Giancarlo Pini (World Food Programme)
- Mariko Fujisawa (FAO)
- Luigi Avagliano (SwissRE)
- Luca Delli Passeri (Dipartimento Protezione Civile Nazionale),
- Alessandro Dell'Aquila (ENEA),
- Francesca de' Donato (Servizio Sanitario Regionale Lazio),
- Franco Desiato (ISPRA)

14:00 – 15:00 Lunch

15:00 – 16:00 Session V (cont.) – Joint session with users and stakeholders

- Round Table
  Moderator : Ernesto Rodriguez Camino (AEMET)

16:00 – 16:30 **Coffee break**

16:30 – 16:45 **Session VI - Conclusions and Recommendations**

16:45 **Closure of MedCOF7**

Annex III: List of participants

PRE-COF TRAINING SESSION
MEDITERRANEAN CLIMATE OUTLOOK FORUM 7 (MedCOF-7)
SOUTH EAST EUROPEAN CLIMATE OUTLOOK FORUM 16 (SEECOF-16)
PRESANORD -10

November 15-23, 2016
Rome, Italy

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Annex IV:

Step 3 of the
MEDITERRANEAN CLIMATE OUTLOOK FORUM (MedCOF-7)
Last updated 23rd November 2016

SEASONAL OUTLOOK FOR THE WINTER SEASON 2015-16 FOR THE MEDITERRANEAN REGION

Climate experts from WMO RA VI RCC Network Node on long-range forecasting (Meteo France and Hydrometeorological Centre of Russia), WMO RA VI RCC Network Node on climate monitoring (Deutscher Wetterdienst, Germany), WMO Northern Africa RCC Network Node on long-range forecasting (Directorate of National Meteorology, Morocco), WMO Northern Africa RCC Network Node on climate monitoring (National Institute of Meteorology, Tunisia), South East Europe Virtual Climate Change Centre (SEEVCCC, Serbia), Euro-Mediterranean Center on Climate Change (CMCC, Italy), Istituto de Biometeorología (IBIMET CNR, Italy), National Hydrometeorological Services and Research Institutes of MedCOF region provided their valuable contribution to the successful implementation of MedCOF-7 by developing the relevant documents and providing scientific guidance and recommendations.

The MedCOF-7 comprised of the following steps:

- Step 1: verification of the MedCOF-6 seasonal forecast
- Step 2: assessment of the current state of the climate including large-scale climate patterns worldwide and assessments of its likely evolution in the course of the next months;
- Step 3: building the consensus forecast for 2016-17 winter season.

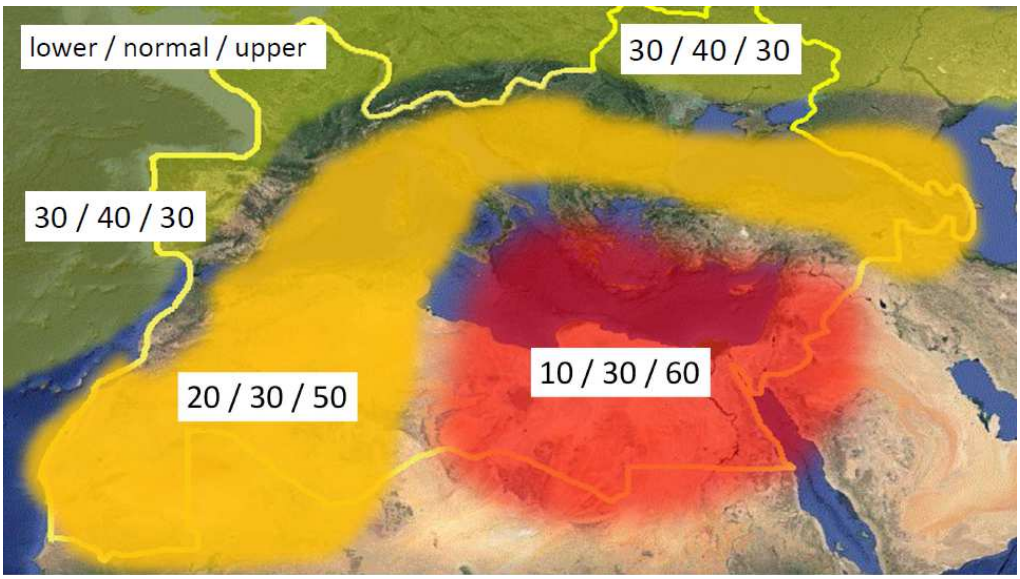
All relevant documentation is posted and updated in MedCOF web site: http://www.medcof.aemet.es .

MedCOF- 7 CLIMATE OUTLOOK

FOR THE 2016-2017 WINTER SEASON[1]

This prediction is based on output from dynamical models, statistical models and known teleconnections of large-scale climate features.

A weak La Niña event now established in the tropical Pacific Ocean seems to be maintained during the remainder of fall, persisting through mid-winter, then weakening to cool-neutral by later winter. The long lasting North Atlantic cold blob over a large area to the south of Greenland shows some weakening trend. Although tropical ocean forcing is relatively weak, possible teleconnections from North Atlantic tropics suggest some perspective of anomalous cyclonic circulation over Southern Europe consistent with a negative phase of NAO. Finally as a summary, a significant number of GPC models shows as common feature some slight predominance of a positive phase for EA and SCAN patterns of variability and also climate drivers tend to point to an enhance occurrence of negative NAO.



[1]The graphical representation of climate outlook in this statement is only for guidance purposes, and does not imply any opinion whatsoever concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Figure 1. Graphical presentation of the 2016-17 winter temperature outlook. The maps show the probabilistic consensus forecast for tercile categories of anomalies for seasonal mean temperature, relative to the period 1981-2010. Due to the climate warming trend anomalies are affected by the selected reference period.

Due to the contradictory forcing over the North Atlantic/European sector with mean circulation dominated by a positive EA pattern with potentially cold episodes during negative NAO periods (possibly more frequent than climatology), there is uncertainty in the forecasting systems' prediction of large-scale atmospheric circulation during the winter. However, the most probable scenario over the Mediterranean basin is a cyclonic signal in the western part -due to the mentioned teleconnection from the tropics- and a high geopotential anomaly over Middle East.

This probable scenario would explain the consensus for a positive gradient of temperature anomalies pointing from the NW to the SE of the domain (see figure 1).

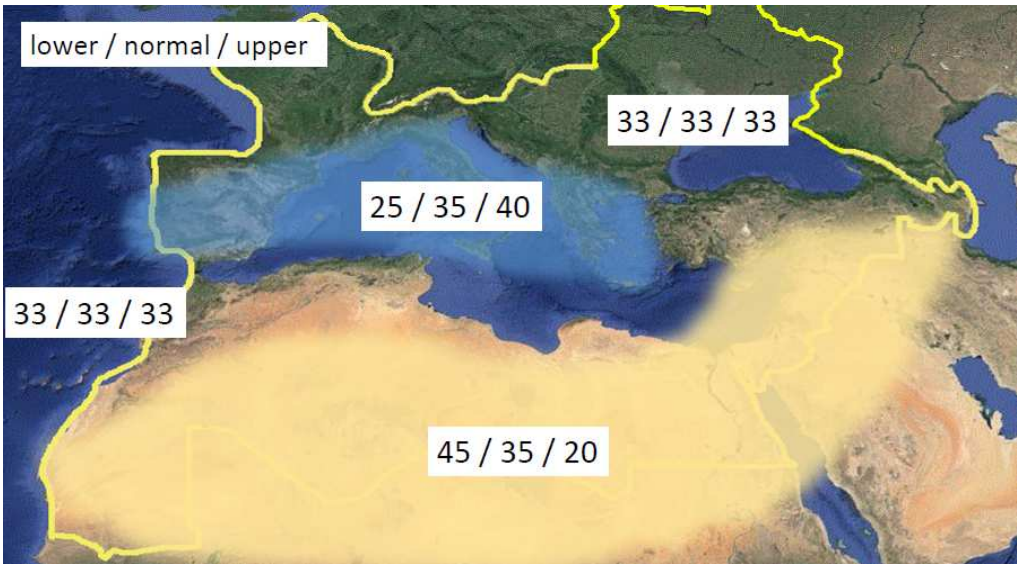


Figure 2. The same as figure 1 but for precipitation.

Although precipitation uncertainties are larger than for temperature, over the central part of the MedCOF region a wetter-than-normal winter is favoured, whereas over Middle East a drier-than-normal would predominate. For the rest of the region no large-scale precipitation signal is present in the forecasts (see figure 2).

Sub-seasonal variations, not predictable a long time in advance, may dominate at times, so regular updates to the forecast are strongly recommended. In addition, local factors (for example SSTs in the smaller basins of the region) may shape local variability at a regional level.

Note that it is necessary to express seasonal forecasts in terms of probability due to inherent uncertainty. Any further advice on the forecast signals, smaller scales, shorter-range updates and warnings will be available throughout the winter from the National Meteorological Services, along with details on the methodology and skill of long-range predictions.

APPENDIX: Contributors to MedCOF-7

- World Meteorological Organization
- European Centre for Medium Range Weather Forecast, United Kingdom
- Meteo France, Republic of France
- Roshydromet, Russia
- Agencia Estatal de Meteorología, Spain
- Deutscher Wetterdienst, Federal Republic of Germany
- National Centre of Meteorology and Aeronautical Climatology, Italy
- Euro-Mediterranean Center on Climate Change, Italy
- Institute of Biometeorology, Italy
- South East European Virtual Climate Change Center hosted by Republic Hydrometeorological Service of Serbia, Republic of Serbia
- National Meteorology Office, Algeria.
- Egyptian Meteorological Authority, Egypt
- National Institute of Meteorology and Hydrology, Republic of Bulgaria
- Meteorological and Hydrological Service, Republic of Croatia
- Meteorological Service, Republic of Cyprus
- Meteorological Service, Israel
- Meteorological Department, Jordan
- Meteorological Department, Lebanon
- National Environmental Agency of Georgia, Georgia
- Hydromet Service, Armenia
- Republic Hydrometeorological Institute, Former Yugoslav Republic of Macedonia
- Ministry of Transport, National Office of Meteorology, Mauritania
- Institute of Hydrometeorology and Seismology of Montenegro, Montenegro
- National Centre for Meteorological Research, Directorate of National Meteorology, Morocco
- National Meteorological Administration, Romania
- Republic Hydrometeorological Service of the Republic of Srpska, Bosnia and Herzegovina
- Federal Hydrometeorological Institute, Bosnia and Herzegovina
- Hydrometeorological Center, Ukraine
- Slovenian Environment Agency, Meteorological Office, Slovenia
- State Hydrometeorological Service, Republic of Moldova
- Republic Hydrometeorological Service of Serbia, Republic of Serbia
- National Institute of Meteorology, Tunisia
- State Meteorological Service, Turkey