Regional Cooperation in South Eastern Europe for meteorological, hydrological and climate data management and exchange to support Disaster Risk Reduction Project

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THE FOURTH SESSION OF SOUTHEASTERN EUROPE CLIMATE OUTLOOK FORUM

Belgrade, Serbia, November 22-26 November 2010

SUMMARY OF DISCUSSIONS

1. INTRODUCTION

1.1. The fourth session of the Climate Outlook Forum for SEE (SEECOF - 4) was held from 22 to 26 November 2010 in Belgrade, Serbia on the kind invitation of the Republic Hydrometeorological Service of Serbia.

1.2. Organization of SEECOF - 4 , like the SEECOF - 2, was an important part of WMO project for supporting disaster risk reduction through regional cooperation for meteorological, hydrological and climate data management and exchange (DRR/SEE Project) in IPA beneficiaries in SE Europe which is financed by the European Commission DG Enlargement.

1.3. The SEECOF - 4 was held as a two-stage event:

- Part A: Pre-COF Capacity Building and Consensus Outlook Generation, 22-24/11/2010,
- Part B: SEECOF - 4 Session, Consensus Outlook Issue & User Interaction 25-26/11/2010

1.4. The approved SEECOF - 4 agenda is attached as **Annex 1**.

1.5. During the capacity building part, the participating climate experts were trained in using, interpreting and downscaling global seasonal prediction products, and in developing a consensus outlook.

1.6. During the Forum Session, a consensus climate outlook for South-East Europe for the winter season 2010/2011 has been developed.

1.7. The user's community was also invited to join the Forum, held during the last two days, in order to facilitate the dialogue and promote the use of Regional Climate Outlook Forum (RCOF) products by the climate sensitive user sectors.

1.8. The meeting was attended by 38 participants from 14 South-eastern European countries, among which: the forecasters and the end-users from seven IPA beneficiaries: Albania, Bosnia & Herzegovina, Croatia, the FYR of Macedonia, Montenegro, Serbia and Turkey; and the forecasters from: Azerbaijan, Bulgaria, Georgia, Greece, Israel, Romania and the Republic of Moldova. The SEECOF - 4 was technically supported by Emily Hamilton and Anca Brookshaw, the Climate Products Scientists from UK Met Office Hadley Centre and Simon Mason, Chief Climate Scientists from the International Research Institute for Climate and Society (IRI USA). The list of participants is attached as **Annex 2.**

2. OPENING SESSION

2.1 Mr. Milan Dacic, the Director of the Republic Hydrometeorological Service of Serbia and the Permanent Representative of Serbia with WMO, opened the session and welcomed the SEECOF - 4 participants on behalf the Republic Hydrometeorological Service of Serbia and on

the behalf of the Virtual Climate Change Centre for SEE, thanking WMO Secretariat and the European Commission Directorate for Enlargement for the support of this event through the Disaster Risk Reduction project in SEE. He encouraged all to continue efforts towards the SEECOF activity in the region with the hope that it could deliver outcomes that are on the economic, scientific and societal benefits, no matter physical or on line sessions are held, since the third SEECOF as online session has already proved the possibility to collaborate intensively without the actual, physical presence. He wished all a successful meeting.

2.2 Mrs. Natalia Berghi, WMO Secretariat Representative, welcomed the participants on behalf of WMO Secretariat, and underlined the importance of the Forum, that being promoted by WMO along with other international agencies, constitutes an important vehicle in sub-region for providing advanced information on the climate for the next season and beyond, with the view to develop a consensus product among the multiple individual predictions. She also mentioned that RCOFs stimulate the development of climate capacity in the NMHSs and facilitate end-user liaison to generate decisions and activities that mitigate the adverse impacts of climate variability and change and help communities to build appropriate adaptation strategies. She reminded that the RCOF efforts in RA VI which started with its first session in Zagreb, Croatia, in June 2008, have been supported by the Regional Association at its XV session in Brussels that urged the Drought Management Centre for South-eastern Europe, the South-east European Virtual Climate Change Centre and the WMO Members in the sub-region to further support the SEECOF process. She also noted that the RAVI Management Group approved the establishment of the Task Team on RCOF, within the RA VI Working Group on Climate and Hydrology, to support the existing regional mechanism, that continued with its second physical session in Budapest, Hungary, and its 3rd session as an online Forum, the last one proving the technical viability of the on-line method for the COF through exchange of e-mails, on-line forum on a dedicated website. Noting the considerable value of RCOFs, efforts have been made by WMO Secretariat to mobilize resources towards the successful organization of the 4th session of this mechanism that develops the capabilities of NMHSs in using, interpreting and downscaling seasonal prediction products into regional and national products. She urged the forecasters to make use of the training possibilities, as an integral component of the RCOF process, in downscaling of climate prediction/projections to appropriate regional/national scales, verification, and development of user liaison and for the generation of tailored climate products for a more reliable seasonal climate outlook. She thanked Mr. Dacic, the Permanent Representative of Serbia for his pro-active approach to host the 4th SEECOF session. She also thanked the Met Office of the United Kingdom of Great Britain and Northern Ireland and International Research Institute for Climate and Society of the United States of America for sharing their knowledge and related expertise towards a successful organization of the Forum.

2.3 Due to his participation in the session of WMO Commission for Basic Systems, held in Namibia, Mr. Ivan Cacic, RA VI president remotely addressed the SEECOF - 4 participants and expressed his appreciation towards the progress of the Regional Climate Outlook Forum process in RA VI as the significant part of the forthcoming Global Framework for Climate Services including the Climate Watch System. Noting that RCOF is actively supporting the process of the capacity building and development of RA VI Regional Climate Centre network structure and its three nodes related to Climate data, Climate monitoring and Long-range forecasting, where the Republic Hydrometeorological Service of Serbia with its Sub-regional Virtual Climate Change Centre and Drought Management Centre for SEE has good perspective to play prominent role, he thanked WMO Secretariat, the PR of Serbia with WMO and RA VI Working Group on Climate and Hydrology for supporting this important regional event through the working regional mechanism.

3. Part A - Pre-COF Capacity Building & Consensus Outlook Generation (22-24 November).

3.1 Mr. Dacic delivered a presentation on *SEECOF mechanism: Background and Strategy* informing the participants on the objectives of World Climate Applications and Services Programme, and Climate Information and Prediction Services (CLIPS) Project of WMO which lie on the RCOF basis. Displaying the scheme of RCOFs worldwide the participants were recalled that RCOF mechanism started in 1996 in Zimbabwe. He mentioned that South-eastern Europe (SEE) has held three RCOFs with the first session in SEE in 2008 in Zagreb, Croatia. It was

stressed that the 3rd SEECOF was held as an online Forum and proved its technical viability. The participants were informed on the role of RCOF for the Climate Change issues as well as Elements of Climate Information Services within the Global Framework for Climate Service. The participants encouraged to familiarize themselves with the research position papers with recommendations issued in 2008. A RCOF Newsletter would provide a one stop informative source with recommendations. The participants were further informed on the establishment of WMO RAVI Pilot Network of Regional Climate Centres and the SEE Virtual Climate Change Center, as regional mechanism to support the climate capabilities of the NMHSs. In conclusion, it was stressed the need for the multidisciplinary cooperation.

3.2 Mr. Branko Bijelic, from the Republic Hydrometeorological Service of Serbia/South East European Virtual Climate Change Centre (RHMSS/SEEVCCC) gave an overview of the SEECOF-III on line meeting that consisted of three steps, as follows:

1. Qualitative verification of the SEECOF-II climate outlook for winter 2009-2010;
2. Assessment of current state of the climate including large-scale climate patterns worldwide and assessment of its likely evolution;
3. Preparation of a Consensus Climate Outlook.

3.3 The first step was based on the reports from SEE countries, operational products, climate monitoring review of summer season 2010 and brief assessment of the correctness of the SEECOF 3 climate outlook for summer 2010 of the European Climate System Monitoring – ECSM (RCC Node on Climate Monitoring), climate monitoring products of the South East European Virtual Climate Change Centre - SEEVCCC (Member of the WMO RA VI Pilot RCC Node on Climate Monitoring and the final assessment of correctness of the SEECOF-II. The issues raised during the 1st step were: the referent period, the notion of the high impact event, and others. The second step focused on assessment of the current state of the climate based on the climate models from ROSHIDROMET, Meteo France and ECMWF. Lessons learnt for further action in support of future SEECOFs were discussed. A Consensus Climate Outlook for the summer 2010 was prepared as a final 3rd step of the SEECOF-III. More info on the SEECOF-3 online meeting is given as **Annex 3a**.

3.4 Ms. Jasminka Smailagic presented the Monitoring results for summer 2010 & evaluation of SEECOF-III outlook on behalf of RCC node for Climate Monitoring noting the recording of the global temperatures anomalies for summer 2010 (June-July-August), making the summer 2010 as the 2nd warmest summer since 1980 on almost the whole territory of RAVI. The global precipitation anomalies according to GPCC data showed a dry period over central Russia extended over South Caucasus, particularly Georgia and Adriatic Sea and Eastern Mediterranean. The summer showed a transition from wet to dry conditions. A list of significant events, in particular several heavy rains that occurred in summer 2010 in SEECOF region was compiled and presented.

3.5 As result, the participants encouraged the development and presentation of the dry-season maps for the next SEECOFs. It was also noted that the history of the institutional memory can bring additional info and the reference period is to be taken into account while considering the national inputs.

3.6 Mr. Branko Bijelic presented the outcome of the 3rd Forum discussion and the final consensus discussion providing the list of products based on which the final consensus statement was issued. Summer season temperature and precipitation maps were presented. The list of organizations contributing to the seasonal climate outlook for summer 2010 was presented and the national inputs were tabled.

The participants noted that different approaches to the seasonal products are used in the region, but a verification system is to be agreed. It was noted that the Climate Prediction Tools (CPT) besides the GPC products were one of the basis of the seasonal forecasts for summer 2010. The climate outlook for summer 2010 was finally approved by participants.

3.7 Mr. Bijelic also presented the outcome of the discussion of the Pre PRECOF on the 4th

Forum as well as draft version of final assessment of the SEECOF-III climate outlook for summer 2010 as a suggestion for the final consensus discussion providing the list of products based on which the draft version was issued. More info is given in the **Annex 3 b**.

Training session

3.8. Mr. Simon Mason, from International Research Institute for Climate and Society, USA presented an overview of the Climate Prediction Tool (CPT) that was developed to address: (1) the slow production time; (2) expensive pre-COF sessions; (3) limited availability of monthly updates; (4) artificial skills; (5) lack of vigorous performance evaluation; and (6) minimal consideration of global products. He focused particularly on the canonical correlation analysis (CCA) function of the software, pointing out the advantage of using CCA over multi-linear regression. He also explained some of the theory behind principal component analysis, which is an important part of the CCA technique.

3.9. Mr. Mason worked through an example of how to use the CPT to make a forecast of seasonal mean temperature over the SEE region for the December, January and February (DJF) period. For this prediction he used observed sea surface temperatures (SST) in October as the predictor. The relevant data (observed SST and observed temperature) had already been distributed to SEECOF participants, so they were able to follow Simon Mason and make similar forecasts for the entire SEE region and specific forecasts for their own countries.

3.10 The next session was spent with SEECOF participants experimenting by adjusting the parameters of the CCA to optimize the skill of the forecasts. Simon Mason and Emily Hamilton, Climate Products Scientist of the Met Office Hadley Centre, helped those who had difficulties or had questions. Participants Questions and Answers of Mr. Mason, regarding to CPT is given in **Annex 4.**

3.11. In the final session, the North Atlantic Oscillation (NAO) index, seasonal hindcast data and the most recent seasonal forecast data from the general circulation models (GCMs) of Meteo-France, ECMWF and the UK Met Office were used as predictors. In this session Simon Mason gave demonstrations using the GCM data and the NAO index. Mr. Mason and Ms. Hamilton helped those participants who had questions. The CPT 10 version was used for the training as the new CPT version is still being tested. Nevertheless, the participants were encouraged to register at the CPT web page to get the latest version of the CPT: http://iri.columbia.edu.

3.12. Ms. Anca Brookshaw presented the latest *developments in long-range forecasting at the Met Office Hadley Centre.* Her presentation covered both operational aspects and research activities. She presented an outline of the latest operational system for seasonal forecasting (GloSea4 Model); highlighting the improvements this brings on the previous version. Improved capabilities and better models are expected in future. A summary of current research activities aimed at understanding predictability and improving predictive skill over Europe concluded the presentation. The participants were interested to know what is the data policy of UK Met Office regarding the LRF products. Ms. Brookshow answered that the test forecasts are available, but hind cast products are available only with the agreement. Usually members call UK Met Office and negotiate. The members are encouraged to use GPC's and UK Met Office is interested to have a feedback. Next question was how carbon cycle is implemented in model. Ms. Brookshow answered that in regional model for the purposes of IPCC scenario prediction carbon cycle is included.

3.13. Mr. Peer Hechler, Seconded expert to WMO Secretariat, informed the participants on GPC products, which was established by the World Climate Conference-3 held from 31 August to 4 September 2009 in Geneva, Switzerland to strengthen the production, availability, delivery and application of science-based climate prediction and services. He briefed the participants that the GFCS consists of five pillars mainly following the cycle of climate service generation and delivery: (i) Observations component, (ii) Research, Modelling and Prediction component, (iii) Climate Services Information System component, (iv) Climate User Interface Programme component and – as a cross-cutting component- (v) capacity building. He added that the Climate Services Information System (CSIS) is the component of the framework that is

designed to routinely generate climate information which users need for the decisions they have to make. He highlighted that WMO is -and will be- contributing significantly to this GFCS component, listing the relevant current strengths that include: (i) WMO's Global Data Processing and Forecasting System (GDPFS) with twelve WMO Global Producing Centres for Long-range Forecasting (WMO GPCs) and two associated Lead Centres on Long-range Forecasting Multi-Model Ensembles (LC-LRFMME) and on Standard Verification System for Long-range Forecasts (LC-SVSLRF) as well as two designated WMO Regional Climate Centres (WMO RCCs), (ii) regional institutions, such as Drought Management Centres, the African Centre of Meteorological Applications for Development (ACMAD), the IGAD Climate Prediction and Applications Centre (ICPAC), the Centro Internacional para la Investigación del Fenómeno de El Niño (CIIFEN) etc., (iii) provision of standards and best practices, e.g. through its Technical Commissions for Basic Systems (CBS) and for Climatology (CCl), and (iv) WMO El Niño/La Niña Updates. Future WMO contributions to the CSIS comprise: (i) elaboration of concepts on National Climate Services (NCSs) and National Climate Centres (NCCs), (ii) extension of WMO GPCs and WMO RCCs to cover all climatic regions, (iii) expansion of RCC operations to cover regional climate change scenarios, and (iv) development of additional global climate updates.

3.14. Mr. Goran Pejanovic, the director of the SEEVCCC informed the participants on the activities and recent products of the SEEVCCC. Main activities within the RA VI RCC Network linked to climate data (KNMI, ECAD), climate monitoring (DWD, ECSM) and LRF (Meteo-France, Roshydromet) are accomplished in cooperation with main RCC Nodes. Some problems concerning the use of direct LRF (RCM-SEEVCCC) ensemble model outputs for precipitation and temperature were shown. Forecasted (relatively poor) and monitored precipitation for June 2010 were compared. Highly recommended function for SEEVCCC is to build an integrated model system based on NMM-B Atmospheric driving model that includes three main components such as ocean, aerosol and hydrology.

3.15. Mr. Bijelic encouraged the participants to discuss the following issues:

- The exchange of the SEE Climate Outlooks between NMHSs;
- The use of CPT for seasonal forecast;
- The difficulties to access and use the GPC data or other input materials.

An exiting LRF practice in SEE countries, reported by the participants is given in **Annex 5**

3.16. He mentioned that the input data are the data of the Global Prediction Centres freely available on the web sites which is adapted to the local data and summary is prepared on the seasonal forecast.

- *Poor skill* - Several countries from the sub-region received complaints on the poor skill of the seasonal climate outlooks which confuse the decision making of the end-users.
- *Unofficial publications of seasonal climate forecast* - Problems are encountered with the mass-media who publish info on seasonal forecasts based on international sources that causes public agitation / disturbances and requests local climate expert explanations.
- *No common reference period* - Lack of common climate reference period impedes the analysis.

3.17. Ms. Anca Brookshaw assisted to review the current large scale climate anomalies, including sea surface temperature pattern and most recent predictions of their further evolution. To produce the first draft consensus outlook for winter 2010-2011 the following were considered and summarized by the forecasters from the SEE:

- The SSTs observations,
- La Nina teleconnections,
- Atlantic, Pacific and Indian Oceans indices
- The Global Prediction Centres forecasts for December January – February 2010-2011

(from LC-LRFMME website)

- The ECMWF models results,
- The Meteo France models results,
- The UK Met Office GloSea models result,
- The Russian Federation HMC model results, and
- The IRI, USA models (for Asia).

Country presentations

3.18. Participants from Bulgaria, Croatia, Greece, Israel, Romania and Serbia delivered each a 5 minutes presentation on the climate outlooks for winter 2010-2011. A summary of the climate experts' presentations with the results of the forecasts for the next season is provided below per country:

3.19. Mr. Ilian Gospodinov, from National Institute of Meteorology and Hydrology of the Academy of Sciences of Bulgaria presented the Seasonal Forecast for Winter 2010/11 in Bulgaria. He mentioned that the regular seasonal forecast for Bulgaria is produced since 2005 and updated once a month at the end of the month as soon as all forecast materials become available. Bulgaria is considered relatively small compared to the spatial uncertainties of the modern seasonal forecasting materials. That is why a single index valid for the entire country is forecasted without detailing for different regions except occasionally and only for the first month based on analysis of the medium range weather forecast. The basis of the forecast that consists of four components is listed and described as follows:

- *Subjective analysis of the anomaly and probability map* products from the climate prediction models of the Global Prediction Centres: This analysis results into a synthesis that is a weighted average of what the different models infer for the region of Bulgaria in terms of most likely tercile category.

- The UK Met Office forecast for the phase of *the North Atlantic Oscillation (NAO) for the coming winter:* It is based on a relationship between the Sea Surface Temperature (SST) pattern in the North Atlantic in the month of May and the phase of NAO in the following winter.

- The global climate prediction centres agree in their forecast that the developing *La Nina phase of the Southern Oscillation will hold for the entire winter season and beyond*: This forecast is considered fully reliable. The recent data suggest that El Nino in winter works toward rather wet and warm conditions in Bulgaria and La Nina works toward rather cold and dry.

- The seasonal forecast is also detailed month by month based on *subjective analysis of the monthly anomaly and probability maps* from certain centres: It suggests for a cold to normal winter with a rather cold and dry month of January. The winter season of 2010/11 should rather be colder and drier than the one of 2009/10. The reference period that was used for evaluation of the performance of this forecast is 1980-2009.

3.20. Mrs. Dunja Mazzocco Drvar from Meteorological and Hydrological Service of Croatia presented the Main activities of the Weather Analysis and Forecast Department. She mentioned that the seasonal weather forecast in Croatia is produced since 2005, and presented the results of the forecast for the coming winter 2010-2011. She also mentioned that since 2009, the Meteorological and Hydrological Service of Croatia has a contract- based user of the seasonal forecast, the Hydro- Electric Power Company that joined the 4th session of the Climate Outlook Forum.

3.21. Mrs. Flora Gofa from Hellenic National Meteorological Service gave an overview on the research -based only seasonal forecast that includes a monthly climatological bulletin with the analysis of the deviations from climatological averages for each region of the country and the Plots available though ECMWF Seasonal Forecasting System on a monthly basis.

3.22. Mr. Yoav Levi from Israel Meteorological Service presented *the Seasonal forecast for precipitation in Israel. He mentioned that* 26 hindcast years of the Japanese Sintex coupled model shows the model has no skill for precipitation forecast over Israel. For the current NDJ (2010-2011), NCEP predicts a drought, UKMO a wet season and ECMWF has no skill. Therefore, it was concluded that if a seasonal forecast is needed the old teleconnection method is to be applied. NCEP reanalysis of 1000-200 hPa heights and temperatures together with Kaplan SST data base were used. The method subtracts about 50 predictors with correlation coefficients above 0.45 with the average precipitation in 21 stations over Israel. As the correlation centres are not stable in time only the last 30 years are used. These predictors are then entered into CPT to produce PCR forecast. The highest correlation was found between the 1000 hPa level in the nino3.4 area. As for other predictors the correlation changes dramatically with time. 20 year running average reveals that in the 70's there was a positive correlation of 0.4 that altered to a negative correlation of –0.8 in recent years. The forecast for the coming DJF season based only on the nino3.4 Z1000 height predictor gives a probability of 76% for sever drought (-55%). Including all 50 predictors do not alter the situation and give below normal precipitation but not an extreme.

3.23. Mrs. Roxana Bojariu from the National Meteorological Administration of Romania presented the Research results related to climate prediction. She mentioned that the Climate predictability is regionally and temporally dependent therefore the related strategy has to be regionally-orientated. It was also noted that the existence of scientific significance of climate prediction results does not guarantee socio-economic significance (cost/benefit ratio). It was added that the deontological and ethical implications of climate prediction should be taken into account on regular basis. Mrs. Bojariu further encouraged the participants to make use of the IPCC AR5/CMIP 5 that offers new opportunities to collaborate in climate prediction.

3.24. Mr. Dragan Mihic, from the Republic Hydrometeorological Service of Serbia / South East European Virtual Climate Change Centre (RHMSS/SEEVCCC), gave a preview of products used for building of the very same outlook for DJF 2010/2011 session for the territory of Serbia and whole SEE region has been proposed. Several Global Prediction Centres together with the SEEVCCC Regional Climate Model seasonal products where shown and analyzed.

3.25. Mrs. Anca Brookshaw gave an overview on the long-range forecasting, including the predictability, uncertainty and its sources, the skill that varies with the region, the lead time, the time of year and the variable, and some other issues 'specific' to long-range predictions such as: the reference period, the temporal and spatial representativity and bias. She continued with the Met office long-range prediction system and monthly, seasonal and decadal products for business, commercial and consultancy purpose, giving examples of seasonal forecast using GloSea model, an enhanced version of the Hadley Centre Climate model HadCM3. The participants learned on the Seasonal forecast information pages of Met Office: http://www.metoffice.gov.uk/science/specialist/seasonal .

3.26. The Part A concluded with the approval of the climate outlook for the next winter 2010 - 2011.

4. PART B: SEECOF - 4 Session: Consensus outlook & user interaction (25-26 November)

4.1 The Part B of the Climate Outlook Forum was opened by the PR of Serbia with WMO, Mr. Dacic, who welcomed the participants: climate experts, end-users and the representatives of mass-media and underlined that this is a second part of the Forum that prepared the climate outlook for the next winter for SEE with the assistance of UK Met Office experts and WMO Secretariat.

4.2. WMO Representative, Mr. Peer Hechler mentioned that the climate risk and climate change adaptation are now being the main challenges for the entire world, noting that the SEECOF is organized to partly address this challenge together with the climate experts from the region, the end-users and WMO. He thanked the Government of Serbia in particular the Republic Hydrometeorological Service of Serbia for the pro-active approach to support this regional mechanism and thanked the climate experts and the end-users for their participation.

4.3. Mr. Dacic, then, briefed the end-users on the work done by the climate experts during the first three days of the Forum who convened to exchange their experience and knowledge towards the improvement of the seasonal climate forecasts and deliberate on the evolution of the atmosphere elements that influence the climate for the next winter. He also thanked the participants in particular the end-users for their participation in this regional mechanism and wished all a successful continuation of the meeting.

4.4. Mr. Peer Hechler introduced the components of the Global Framework for Climate Services and Climate Services Information System approved by WMO Members at the World Climate Conference, held in May 2009, in Geneva, Switzerland. He noted that the further contribution of WMO Secretariat to the GFCS will be to support its Members to develop the NMHSs capabilities to provide the climate services and products to the end-users. In this regard, the establishment of the WMO Regional Climate Centres and the Regional Climate Outlook Forums, the publication of the WMO El Nino/La Nina Updates and WMO Climate Watch System are good examples, supported by other regional initiatives, such as: Drought Management Centre for SEE, SEE Virtual Climate Change Center, and the European Centre for Medium-Range Weather Forecast. Further, Mr. Peer Hechler gave an overview on WMO Global Prediction Centres, WMO associated Lead Centres and other producers of global Long-Range Forecasts on three levels: global, regional and national as an integral part of the Global Data – Processing and Forecasting Systems. He also mentioned the producers of regional / sub-regional LRF: RA VI RCC Network; SEEVCCC.

4.5. The Director of the SEEVCCC, Mr. Goran Pejanovic, presented the SEEVCCC activity and the products for Long-Range Forecasts. (RCM-SEEVCCC) under the ECMWF Seasonal Ensemble Forecast. Monthly maps for temperature and precipitation and their anomalies were shown, as well as possible digital output parameters. Final extended model integrated area to capture Caucasus region is presented. It was stressed that it is necessary to provide model climatology instead of CRU climatology, currently in use. Also creation of verification system is in progress. In order to approach Climate Watch System (CWS) one example of 2-monthly SPI index based on LRF RCM-SEEVCCC precipitation ensemble mean was given showing extremely wet conditions during January/February 2010.

4.6. Ms. Jasminka Smailagic, presented the SEECOF-3 outcomes on climate for the summer 2010, in particular, the results of SEECOF-3 climate outlook' verification based on a comparison analyses between the expected and the observed temperature, the precipitation and the anomalies. Heat waves and major flooding was recorded in Serbia in the summer 2010. She also mentioned the climate expert informative sources from the region contributing to the 3rd Consensus Climate Outlook for the summer 2010.

End-users presentations

4.7. Mr. Nino Radetic, from the Electric Power Company of Croatia (former assistant director for IT sector of the Hydrometeorological Service of Croatia) presented the relevance of the long-range forecasts for the activity of the Company, and namely for import and export of the electric energy the decision for which is made based on three - levels scenario designed for internal company decision - making process. He mentioned that the risk is to be transferred through the insurance companies or shared with the Hydrometeorological Services. He added that the Electric Power Company would be ready to support the development of the NMHS capability to provide better long-range services and products.

4.8. Mr. Petar Vasiljevic, from the Belgrade Electrical Power Company, presented the activity of the company, who heats about 50% of population with yearly production of heating energy of 3.700 GWh. The company plans yearly the primary energy consumption – energy production for the national gas company, who based on this order the required gas for the winter at the end of summer period. The SCADA programme is used for prediction and monitoring of the energy production. He highlighted that the optimum planning of the energy production directly depends on the timely long-range forecasts of the temperature and precipitation. Therefore, an updated forecast should be provided at least a week in advance to the energy companies that would enable them to undertake the appropriate decision –making steps.

4.9. Mr. Nemanja Beljanski, from Delta Generali Group Insurance Company, highlighted that Insurance industry has a clear interest in having close connection to Hydrometeorological Service. Delta Generali Insurance, as a company recognized this importance and established cooperation with RHMS of Serbia at several levels: using historical and actual data, using specific data on request, and so on. Especially important are the activities made on "Drought Insurance Project", which is the first product of its kind, not only in Serbia, but in this part of Europe. Prospects of this cooperation are significant and diverse. Common efforts should be made in order to provide more precise and more detailed actual data, but also in new insurance product modelling and similar projects. Providing reliable seasonal forecasts will be a tool of a highest importance for insurance companies, and it could be used in several different ways to improve business results.

4.10. Mrs. Anca Brookshaw, from UK Met Office presented the science and methods of the long-range forecast, giving some clarifications on the probabilities and their link to the reference period. She explained what the seasonal forecast is, with the examples showing the predictable and non-predictable space and time average of the hazards (e.g. tropical storms). In this connection, there was mentioned that opposite the weather and the localized events, the climate and the large area average are predictable. She informed on the uncertainty and ensemble forecasts, as the model output. She gave some examples of the skill of the long-range prediction and mentioned that the format of the long-range prediction products depends on the time-range. The presentation aimed to facilitate the understanding by the users of the way the consensus outlook is framed.

4.11. Mr. Dragan Mihic, from the RHMSS/SEEVCCC, presented the content of the South East European Virtual Climate Change Centres' web page (www.seevccc.rs). He described the structure, operational products, from Climate monitoring to seasonal and dust forecasts, and also other useful information and documents that could be found on this web page. He noted that the SEECOF outlooks will be made available on the SEEVCCC webpage.

4.12. Mr. Branko Bijelic, from Republic Hydrometeorological Service of Serbia and the SEEVCCC presented the SEECOF - 4 outlook, that is based on the dynamical, statistical models and known tele-connections of large scale climate features, noting that the consequences for temperatures and precipitation vary across the region due to local factors and there are higher probabilities for below –average than for near –or above average temperature in the NW part of the Region. The prediction of the uncertainty increases towards the SE part of the SEE. For the southern and eastern regions of the domain (see map) there is currently no predictive signal.

4.13. Question to the users: Is the outlook in such a shape of any help for the users? The insurance company expressed the interest to get the minimum temperature at a certain time for winter frosts and not the average temperatures, as it is now stated in the outlook. Moreover Mr. Beljanski mentioned that a complementary info on the snow cover for example, in addition to the temperatures, would be highly appreciated to bring more value for the concerned sectors (transport, agriculture, etc.). The climate experts mentioned that at this stage they can propose one option to deal with such requests, and namely to provide the user with statistics on the number of days with winter frost for 'normal 'and 'below normal' years.

4.14. Mr. Peer Hechler concluded the lessons learned to be considered in the future and listed some technical as well as general and strategic issues, to be considered by SEECOF focal points, such as reference period, verification and communication to users including the public (e.g. press release), translation of the outlook into the national language, establishment of the SEECOF website, identification of the resource persons from the sub-region, the need for training of the climate experts to use the long-range forecast tools, and for the users to understand better the outlook; the comparison of the knowledge on the climate variability, the format and way to hold next Forums. He proposed a draft list of recommendations for consideration and comments, encouraging discussions on the SEECOF process and future perspectives.

4.15. The Day 1 was closed with the adoption of the Consensus statement on the climate outlook for winter 2010-2011, attached as **Annex 6**.

4.16. Mr. Hechler presented the standardization of climate monitoring information in SEECOF in particular on high impact events and reference periods aimed at facilitating the collection of climate information. It was noted that WMO standard climate reference period is 1961-1990; however the participants were encouraged to agree on the common reference period for SEECOF. The notion of the high impact event was given and the e-forum was proposed to continue opinions and proposals on a common reference period for SEECOF and a better term for climate events that might cause an impact.

Climate change session

4.17. Climate change session started with the presentation of Mrs. Roxana Bojariu from National Meteorological Administration of Romania on IPCC Precipitation Projections and sub-ensemble average evolution for Romanian precipitation as well as regional changes in temperature forecast for 2070-2099 vis-à-vis 1961-1990. She concluded that there are large uncertainties in projection the precipitation compared with the temperature and there is a hope that the next generation of climate models would reduce the uncertainties.

4.18. Mr. Vladimir Djurdjevic, SEEVCCC expert presented the development and application of SEEVCCC Regional Climate Model based on ocean data including the future scenario of A1B and A2 IPCC SRES for the period from 2071 to 2100 for SEE region. *According to the scenario results, in winter the region will have positive precipitation changes and in summer there will be negative precipitation changes.*

4.19. The SEEVCCC expert team presented the application of Regional Climate Model in impact studies (e.g. agriculture, water resources), the statistical bias correction to reduce the bias error of the results. The results of a series of indexes, such as: the helio-thermal index, the dryness index and the cool night index, for 21st century were presented.

4.20. Mrs. Aleksandra Krzic from SEEVCCC presented some methods of monitoring and forecasting moisture conditions in Serbia giving the examples of extreme wet and dry conditions including the RCM of SEEVCCC LRF products use. The results of the crop model were presented in the form of a bulletin issued by the RHMSS,

4.21. Mr. Goran Pejanovic presented the results of the hydrological HYPROM model as a tool for water resources assessment, enabling to assess also the soil moisture, the snow height and other indexes. An example of the flash flood study on the Savinja River in Slovenia was given. He mentioned that the weakness of the model is few hours delay in producing the major rainfall. The Moraca River in Montenegro served as another well forecasted case study.

4.22. Mr. Mihailo Andjelic, consultant for hydrology in RHMSS, gave an overview on WISKI 7 & HBV Hydrological Information Management and Modelling systems implemented at the Hydrology Department of the Republic Hydrometeorological Service of Serbia. He presented its basic features and implementation in Serbia within the 2 years Norway supported project “Hydrological flood forecasting system for small and medium sized catchments in Serbia”, which aims at improving the data management and hydrological flood warning and forecasting services of the Hydrological Department of the Republic Hydrometeorological Service of Serbia.

4.23. The meeting came up with the following conclusions & recommendations:

Conclusions:

- The meting achieved its objectives, issuing a consensus outlook.
- A high interest of participants in CPT was noted.
- The consensus discussion heavily depends on the experts from outside the SEECOF region,
- The low skill of the seasonal forecast is a challenge to be faced.
- There is a need to improve the understanding of climate in SEECOF region and its forcing to facilitate the consensus discussion.

Recommendations:

1. To organize trainings on the use of the CPT and of the dynamic models independent from SEECOF event, following the example of the EUMETCAL training - workshop.

2. To benefit by the ECMWF Seminars to learn how to improve the predictability and to join the efforts to make a review on the influence of predictability;

3. To encourage the Members from the sub-region to hold trainings for the users and vice versa to take the opportunity to learn on the users needs.

4. To focus on scientific review paper on external and internal forcing factors relevant to the SEECOF region's climate regime incl. considerations of a related workshop;

5. To improve the communication with the research community to get updated on the latest findings.

6. To encourage publications with the user component that would be very useful for climate experts;

7. To organize a Regional Conference, with the best practice and show cases, on how better to deliver to the end-users the climate related products & services.

8. To proceed with Online SEECOFs.

9. To agree on a common regional climate reference period;

10. To continue efforts to ensure a consistent hindcast period;

11. To ensure a continue exchange of analyses and provide a consensus or summarized results to reduce the differences in the expert views.

12. Climatology information is to be provided together with the climate outlook to facilitate the interpretation by the end-users.

13. The scientific understandings and user perspectives are to be taken into account while the climate is analyzed and outlook is prepared.

14. To define the climate trend in global mean temperature, at least 30 years of data are needed; therefore a period of at least 30 years should be taken for the climate analyses.

15. To work out, with the Task Team on RCOF, a SEECOF -related strategy;

16. To provide the users with the seasonal forecasts updates in terms of short- and medium - range forecasts;

17. To convert the regional outlook into national ones.

Closure:

The local organizers prepared CDs with the meeting materials and distributed it to all the participants. The participants were also informed that all the SEECOF - 4 related materials will be made available on the SEEVCCC web site, the web link being also available on the WMO Regional web page. A summarized Meeting Evaluation Form is attached as **Annex 7**. The meeting was closed on 26 November at 13:00.

ANNEX 1

THE FOURTH SESSION OF SOUTHEASTERN EUROPE CLIMATE OUTLOOK FORUM (SEECOF-4)

Belgrade, Serbia, November 22-26, 2010

AGENDA

Part A **Pre-COF Capacity Building and Consensus Outlook Generation** **(22-24 November 2010)**		
22 November 2010 (Monday)		
09:00-09:30	Registration	
09:30-10:00	Opening/Welcome addresses	*Milan Dacic*, PR of Serbia; *Natalia Berghi*, WMO Representative
10:00-10:30	SEECOF mechanism: Background and strategy	*Milan Dacic*, PR of Serbia
10:30-10:45	Pre-COF work plan incl. introduction of resource persons	*Host*
10:45-11:15	Coffee break	
11:15-11:30	SEECOF-III on-line meeting (short review)	*Branko Bijelic*, RHMSS/SEEVCCC
11:30-11:45	Monitoring results for summer 2010 and evaluation of SEECOF-III outlook	*Jasminka Smailagic*, (on behalf of RCC node for CM)
11:45-12:15	Forum discussion outcome and Final Consensus discussion	*Branko Bijelic*, RHMSS/SEEVCCC
12:15-13:00	Introduction to CPT training	*Simon Mason*, IRI USA; *Emily Hamilton*, UK Met Office
13:00-14:30	Lunch	
14:30-16:00	CPT practical training	*Simon Mason*, IRI USA; *Emily Hamilton*, UK Met Office
16:00-16:30	Coffee break	
16:30-18:00	CPT practical training	*Simon Mason*, IRI USA; *Emily Hamilton*, UK Met Office
23 November 2010 (Tuesday)		
09:00-10:30	CPT practical training	*Emily Hamilton*, UK Met Office; *Simon Mason*, IRI USA
10:30-11:00	Coffee break	
11:00-13:00	CPT practical training	*Emily Hamilton*, UK Met Office

13:00-14:30	Lunch	
14:30-15:30	CPT practical training incl. discussion of results	*Emily Hamilton*, UK Met Office
15:30-16:00	Coffee break	
16:00-17:30	Global and regional/subregional Long-Range Forecast products relevant to SEECOF	*Anca Brookshaw*, UK Met Office; *Peer Hechler*, WMO; *Goran Pejanovic*, SEEVCCC; *Branko Bijelic*, RHMSS/SEEVCCC
24 November 2010 (Wednesday)		
09:00-10:00	Review of current large-scale climate anomalies (incl. SST pattern) and most recent predictions of their further evolution: Discussion of available prediction products relevant to SEECOF DJF 2010/2011 outlook	*Anca Brookshaw*, UK Met Office; *Goran Pejanovic*, SEEVCCC
10:00-10:45	SEECOF NMHS presentations of national seasonal outlooks for DJF 2010/2011	SEECOF Focal Points/representatives: *Ilian Gospodinov*, National Institute of Meteorology & Hydrology, Bulgaria; *Dunja Mazzocco Drvar*, Meteorological & Hydrological Service of Croatia *Yoav Levi*, Israel Meteorological Service, Israel *Flora Gofa*, Hellenic National Meteorological Service Greece, *Roxana Bojariu*, National Meteorological Administration of Romania
10:45-11:15	Coffee break	
11:15-12:00	SEECOF NMHS presentations of national seasonal outlooks for DJF 2010/2011 incl. discussion	SEECOF Focal Points/representatives: *Dragan Mihic*, SEEVCCC; *Jasminka Smailagic*, SEEVCCC
12:00-12:30	Consensus discussion on the DJF outlook for the SEECOF region	*Anca Brookshaw*, UK Met Office; *Vladimir Djurdjevic*, SEEVCCC
12:30-14:00	Lunch	
14:00-16:00	Cont. Consensus discussion incl. preparation of draft outlook	*Anca Brookshaw*, UK Met Office; *Vladimir Djurdjevic*, SEEVCCC
17:00-20:00	Sightseeing tour	
20:00-22:00	Dinner hosted by RHMSS	

Part B **SEECOF-4 Session: Consensus Outlook and User Interaction** **(25-26 November 2010)**		
25 November 2010 (Thursday)		
09:00-09:30	Opening COF proper	*Peer Hechler*, WMO; *Milan Dacic*, PR of Serbia
09:30-09:45	COF proper work plan	*Milan Dacic*, PR of Serbia
09:45-10:15	Components of the GFCS Climate Services Information System	*Peer Hechler*, WMO
10:15-10:45	Coffee break	

10:45-11:15	General Introduction to WMO GPCs and associated Lead Centres and other producers of global LRF; Producers of regional/subregional LRF – RA VI RCC-Network; SEEVCCC Center	*Peer Hechler*, WMO; *Goran Pejanovic*, SEEVCCC; *Anca Brookshaw*, UK Met Office; *Milan Dacic*, PR of Serbia
11:15-12:00	Presentation of monitoring results for summer 2010 and evaluation of SEECOF-III outlook incl. discussion with users	*Branko Bijelic*, RHMSS/SEEVCCC; *Jasminka Smailagic*, SEEVCCC
12:00-13:00	User presentations	*Nino Radetic*, HEP (Hrvatska elektroprivreda); *Petar Vasiljevic*, PUC Beogradske elektrane; *Nemanja Beljanski*, Delta Generali Group
13:00-14:30	Lunch	
14:30-15:30	Introduction of LRF science and methods	*Anca Brookshaw*, UK Met Office; *Dragan Mihic*, SEEVCCC
15:30-16:00	Presentation of SEECOF-4 outlook incl. discussion	*Anca Brookshaw*, UK Met Office; *Branko Bijelic*, RHMSS/SEEVCCC
16:00-16:30	Coffee break	
16:30-17:00	Cont. Presentation of SEECOF-4 outlook incl. discussion	*Anca Brookshaw*, UK Met Office; *Branko Bijelic*, RHMSS/SEEVCCC
16:30-17:00	Open discussion on SEECOF process and future perspectives incl. communication aspects	*Peer Hechler*, WMO
26 November 2010 (Friday)		
09:00-09:30	Standardization of climate monitoring information in SEECOF: high impact events and reference periods	*Peer Hechler*, WMO
09:30-10:30	Climate change session: Development and application of SEEVCCC Regional Climate Model; A1B and A2 IPCC SRES scenarios in SEE; Application of RCM in impact studies (Agriculture, water resources, …); Priorites for research and development to support the Adaptation within the GFCS	Experts from the SEE Region: *Roxana Bojariu*, NMA of Romania; SEEVCCC/RHMSS experts team: *Vladimir Djurdjevic*, *Goran Pejanovic*, *Mirjam Vujadinovic*, *Ana Vukovic*, *Aleksandra Krzic*, *Petar Spasov*, *Mihailo Andjelic*
10:30-11:00	Coffee break	
11:00-13:00	Cont. Climate change session: Development and application of SEEVCCC Regional Climate Model; A1B and A2 IPCC SRES scenarios in SEE; Application of RCM in impact studies (Agriculture, water resources, …); Priorites for research and development to support the Adaptation within the GFCS	SEEVCCC/RHMSS experts team: *Vladimir Djurdjevic*, *Goran Pejanovic*, *Mirjam Vujadinovic*, *Ana Vukovic*, *Aleksandra Krzic*, *Petar Spasov*, *Mihailo Andjelic;* *Milan Dacic*
13:00-13:15	Closure of SEECOF-4	*Milan Dacic*, PR of Serbia**;** *Peer Hechler*, WMO

ANNEX 2

PARTICIPANTS TO THE FOURTH SESSION OF SOUTHEASTERN EUROPE CLIMATE OUTLOOK FORUM (SEECOF-4)

Belgrade, Serbia, November 22-26, 2010

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PARTICIPANTS TO THE FOURTH SESSION OF SOUTHEASTERN EUROPE CLIMATE OUTLOOK FORUM (SEECOF-4)

Belgrade, Serbia, November 25-26, 2010

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ANNEX 3a

SEECOF-III on-line meeting short review

Under the overall coordination of the Co-Chair of the WMO RA VI Working Group on Climate and Hydrology and experts from the South East European Virtual Climate Centre (SEEVCCC) the online session of SEECOF-III was conducted during April-May 2010.
Representatives from the National Meteorological and Hydrological Services of Southeast Europe and Caucasus region, namely Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Georgia, Greece, Hungary, Israel, Moldova, Montenegro, Romania, Slovenia, Serbia, The FYR of Macedonia and Turkey participated in the implementation of the SEECOF-III.
Climate experts from South Eastern Europe Virtual Climate Change Centre (SEEVCCC) (Serbia) and from the WMO RA VI RCC Network Node on Long-range Forecasting, namely Meteo France (France) and Roshydromet (Russian Federation), and on Climate Monitoring namely Deutscher Wetterdienst (Germany) provided their valuable contribution to the successful implementation of the SEECOF-III, developing the relevant documents and providing scientific guidance and recommendations
SEECOF-III consists of 3 steps:

- Step 1: Qualitative verification of the SEECOF-II Climate outlook for Winter season 2009-2010;

- 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 Summer season 2010.

Forum was prepared with the aim to fulfill all upper-mentioned goals of SEECOF –III meeting in cooperation with colleagues from Secretariat and Co-Chair of Working Group for Climate and Hydrology WMO RA VI and South East European Virtual Climate Change Centre (SEEVCCC) and it is on the link: www.seevccc.rs/forum.
Analyses of the winter season 2009-2010 temperature and precipitation anomalies were based on:

- operational products of the European Climate System Monitoring – ECSM (the ECSM system is a technical platform of the DWD, Lead of the WMO RA VI Pilot RCC Node on Climate Monitoring, http://www.dwd.de/ecsm);

- climate monitoring products of the South East European Virtual Climate Change Center - SEEVCCC (Member of the WMO RA VI Pilot RCC Node on Climate Monitoring, http://www.seevccc.rs/MONITORING-SEECOF-III), and

- national climate monitoring reports of the following SEECOF-III participating countries: Albania, Armenia, Azerbaijan Republic, Bulgaria, Croatia, Cyprus, Georgia, Greece, Hungary, Israel, FYR of Macedonia, Republic of Moldova, Montenegro, Slovenia, Serbia and Turkey (documents available on http://www.seevccc.rs/SEECOF/SEECOF-4/Step%201/

At the end of the Step 1, Final assessment of correctness of the SEECOF-II climate outlook for winter season 2009-2010 was made and it stated:

- Climate outlook for 2009-2010 winter season temperature was correct for the Carpathian region (western parts of Romania), in the southern parts of Dinaric Alps, in the FYR of Macedonia, in the Aegean Sea, in the southern and eastern parts of the

Black Sea, in Turkey and in the southern parts of the Caucasian region. In the rest, smaller part of the SEE region, climate outlook for winter season temperature was less satisfactory.

- Outlook of the winter season precipitation was correct for western parts of the Balkan peninsula (especially in the north part of the Dinaric Alps) and in the Panonian plain. The SEECOF-II was unable to predict winter season precipitations above-normal in the FYR of Macedonia, northern and central parts of Greece, eastern and northern coasts of the Black Sea, along the western coasts (mountainous region) of the Caucasian region and on eastern coasts of the Aegean Sea.

For the 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 SEECOF-III Forum had precious help from:

- Meteo-France, WMO RA VI RCC node on Long Range Forecasting,
- ROSHYDROMET, WMO RA VI RCC node on Long Range Forecasting
- Climate prediction center/NCEP/NWS El Niño**/**Southern Oscillation (ENSO)
- UK Metoffice
- SEEVCCC
- The International Research Institute for Climate and Society (IRI)

At the end, on Step 3, after lively discussion, Forum made Consensus statement of the Climate outlook for 2010 summer season for the SEECOF region. Its states:

- *Summer season of 2010 is very likely to be warmer than normal in the prevailing part of South East Europe and Caucasus region.*
- *Precipitation over the most part of the region is expected near normal with some probability of below normal rainfall over Turkey, South of Balkan Peninsula and Caucasus.*

ANNEX 3b

Final assessment of SEECOF-3 climate outlook for summer season 2010 - Summary

Because of lack of the time Pre PRECOF session of the SEECOF-4 was created with the aim to accelerate Step 1 of SEECOF-4. Pre PRECOF was organized as a process of collecting of the national climate monitoring reports of the NHMS's from the south-eastern Europe and Caucasus region. National climate reports were collected through Forum on: www.seevccc.rs/forum, but also by E-mails.

Short analysis of the summer season 2010 temperature and precipitation and their anomalies for south-east Europe and Caucasus region are based on:

- operational products of the European Climate System Monitoring – ECSM (the ECSM system is a technical platform of the DWD, Lead of the WMO RA VI Pilot RCC Node on Climate Monitoring, http://www.dwd.de/ecsm;
- climate monitoring review of summer season 2010 and brief assessment of the correctness of the SEECOF 3 climate outlook for summer 2010, (ECSM, DWD, Lead of the WMO RA VI Pilot RCC Node on Climate Monitoring, http://www.seevccc.rs/SEECOF/SEECOF%20IV-STEP1/Pre-PRECOF_RCC-Climate_Monitoring_DWD;
- climate monitoring products of the South East European Virtual Climate Change Center - SEEVCCC (Member of the WMO RA VI Pilot RCC Node on Climate Monitoring, http://www.seevccc.rs/imgsrc/clim_mon/201008/, and
- national climate monitoring reports of the following SEECOF-4 participating countries: Armenia, Azerbaijan Republic, Bulgaria, Federation of Bosnia and Herzegovina, Croatia, Cyprus, Georgia, Greece, Hungary, Israel, FYR of Macedonia, Republic of Moldova, Slovenia, Serbia and Turkey (documents available from http://www.seevccc.rs/SEECOF/SEECOF%20IV-STEP1/

VERIFICATION OF CLIMATE OUTLOOK FOR 2010 SUMMER SEASON

The SEECOF III climate outlook for summer season 2010 concluded that seasonal temperatures over south-eastern Europe will be very likely above normal and with some possibility (although with no clear signal) also over the eastern Mediterranean, Turkey and the south Caucasus region. On the basis of aforementioned regional, subregional and national climate monitoring products it appears that the monitored anomalies, however, were clearly above normal over the whole SEECOF area, in the eastern parts even more than over south-eastern Europe. All together, the outlook was correct, but the forecast signal was not so clear as to be expected for these quite strong and extended anomalies.

According to SEECOF III, summer precipitation was expected to be likely near normal with a certain probability for below normal precipitation in southern parts of the SEECOF area and in the south Caucasus region, and for above normal precipitation in some other parts (Carpathian region, the mountain region of Serbia and the south of Bulgaria). The monitored summer precipitation shows that some of these features were quite well predicted (surplus of precipitation in the Carpathian region and the south of Bulgaria, deficit of precipitation in the south Caucasus region), but others not, e.g. the high precipitation over Turkey and Greece.

APPENDIX A: Contributions to pre Pre-COF of SEECOF-4

World Meteorological Organization
Deutscher Wetterdienst, Federal Republic of Germany
South East European Virtual Climate Change Center hosted by Republic Hydrometeorological Service of Serbia, Republic of Serbia
Royal Netherlands Meteorological Institute, The Netherlands
Armenian State Hydrometeorological and Monitoring Service, Republic of Armenia
National Hydrometeorological Department, Republic of Azerbaijan
National Institute of Meteorology and Hydrology, Republic of Bulgaria
Meteorological and Hydrological Service, Republic of Croatia
Hellenic National Meteorological Service, Greece
Meteorological Service, Republic of Cyprus
Department of Hydrometeorology, Georgia
Meteorological Service of the Republic of Hungary, Republic of Hungary
Israel Meteorological Service, State of Israel
Republic Hydrometeorological Institute, Former Yugoslav Republic of Macedonia
State Hydrometeorological Service, Republic of Moldova
Federal Hydrometeorological Service of the Federation of Bosnia and Herzegovina, Federation of Bosnia and Herzegovina, Bosnia and Herzegovina
Republic Hydrometeorological Service of Serbia, Republic of Serbia
Meteorological Office, Republic of Slovenia
Turkish State Meteorological Service, Republic of Turkey

APPENDIX B: **Analysis and verification of SEECOF-3 climate outlook for the summer season 2010:**
Verification summary based on national reports and contributions of the participants of Pre Pre-COF of SEECOF-4 meeting

Country	Seasonal temperature (JJA)		Seasonal precipitation JJA		High Impact Events
		SEECOF-III climate outlook for temperature	Observed	SEECOF-III climate outlook for precipitatition	
Albania		Above normal		Normal	
Armenia (1)	Above normal	Above normal	Below normal	Below normal	During June 2, 6, 12, 16, 18, 23 and 27 convective related severe weather phenomena (thunderstorm, hail with diameter max 35mm, heavy rainfall 58mm, strong wind with wind- gusts up to 30-34 m/s) were observed. Heat wave was observed in the first decade of July, during 10 day period, the temperature in Ararat valley was above 38^0 C, especially on 10-12 July when in Ararat valley and Syunik regions the max values have reached up to 39-41^0C. During above mentioned period, the mean daily temperature was above normal by 5-7^0C on July 14-16, intens rainfall was recorded with the amount of 47-58 mm in the frame of 40-50 minutes. On July16 in Stepanavan, in 10 minutes, period, hail with the diameter of 24 mm was recorded. Drought wearther was recorded in some regions.
Azerbaijan Republic (5)	Above normal	Normal to above normal	Below normal in most parts of the country. Within and above normal only in some highlands and foothills areas.	Below normal	Strong positive (extreme) temperature anomalies occurred over all the country. Average temperature over the country was 4-6^0C, even on 5 June Baku city station recorded up to 8^0C above the norm. During some days maximum air temperatures were above temperatures recorded during the long-term period over many parts of Azerbaijan. As a result in August forest fires occurred in some parts of the country. The acriculture sector suffered from drought. The intensive rainfall was observed in the country only in first part of the June and caused strong floods in the whole country.
Federation of Bosnia and Bosnia and Herzegovina (1)	Above normal	Above normal	Above normal in Bosnia, below normal in Hercegovina	Normal	Biggest sum of precipitation was registered in June. Drought period was in the second decade of July and in the middle of August. Hail was registered only in the northern part of Bosnia in June. Storm wind was registred in July in Gradačac.
Bulgaria (1)	Above to normal	Above normal	Above to normal	Above normal in south-west part, normal for the rest part of territory	No comment
Croatia (1)	Above normal	Above normal	Above normal in the north-eastern	Normal	No comment

			part, normal for the rest part of territory		
Cyprus (1)	Normal to above normal	Normal to above normal	Above normal	Below normal	Extremely high temperatures were recorded during the periods 1-3 and 15-29 of the August, when maximum and minimum temperatures were about 2 to 8°C above normal. Nicosia reached 45.6°C On 1 August, the highest value since the beginning of the 20 century.
Georgia (3)	Above normal	Normal to above normal	Above normal in the north-western part, normal to below normal in the rest of the territory	Below normal	In June, a number of extreme events occurred, such as flashfloods, hail, storms that is usually characterized for June. They caused damage of buildings, roads, in some cases agricultural holdings and harvest were almost totally destructed, on 23 of June due to flooding of the river. Gldanula 2 people died. Especially abundant rainfall (213 mm) was observed in the mountainous part of west Georgia (Legakhare) in the second decade of June. Only two cases of extreme rainfall followed by the overflowing of bridges and roads were registered in East Georgia in July.
Greece (5)	Above normal in the Central and south mainland, normal to above normal in the rest of the territory	Above normal	Normal	Normal in the central and north parts, below normal in the rest of territory	No comment.
Hungary (2)	Above normal	Above normal	Above normal	Normal	No comment.
Israel (2)	Above normal	Normal to above normal	No verification	Below normal	The summer season temperatures over Israel were the highest measured at least during the last 40 years with ~2ºC above 1971-2000 averages. There is no summer season precipitation.
FYR of Macedonia (1)	Above normal		Above normal in the north and north-eastern parts, below normal over the other part of territory	Normal in greater part, above normal in the east of territory	No comment
Republic of Moldova (1,3)	Above normal	Above normal	Normal	Western parts of the country - above normal; normal in other parts of the	The average air temperature for this season was 21,2°C to 23,7°C in the territory, by 2.1°C to 3,0°C higher compared to the norm that is observed once in 20-30 years. Maximum air temperature during the season grew to 39°C (August, Tiraspol), that is registered once in 10

				territory (forecast is not reliable)	years. Especially hot and also dry was from August, 1 till August, 16. So, the average air temperature for the first decade of August was 24.4-27.6 ºC and that was 4.3-5.5 ºC below normal. On many parts of the territory it was observed for the first time during the whole period of instrumental measurements. The number of days with maximum air temperature of 35°C and more reached during the summer season constitutes 17 days (SM Tiraspol), the norm being 2 days and that is observed once in 20 years. The amount of precipitations fallen during this season on the most of the territory was nearly to the norm and constituted 200-270 mm or 80-120% of the seasonal norm. Locally their quantity reached 290-380 mm or 160-190% of the norm. The largest amount of precipitations in the summer season fell in the regions Briceni MS (473 mm) and Edinet (432 mm) or 72-80% of the annual norm that is indicated in these places for the first time from the entire period of observations. The rainfall during the summer has fallen unevenly. The largest amount of precipitations was recorded in June, in fact, 100-220 mm or 150-270% of the monthly norm. In August, on the contrary, there was observed on the most of the territory a significant rainfall deficit - 9-40 mm or 20-70% of the monthly norm. During the above mentioned season hydrometeorological phenomena were recorded as torrential rain and hail. Heavy rains and hail, fallen in the first half of July have caused significant damage: flooded houses, farm items, disconnection of electricity, damage to agricultural land, also, had influenced grain crops harvest.
Montenegro		Above normal		Normal	
Romania		Above normal		Above normal in the northern parts, normal in the rest of territory	
Slovenia (1)	Above normal	Above normal	Above normal in parts of the Julian Alps, Goriško, Kras, Coastal area and Prekomurje region, elsewhere below normal.	Normal	Everywhere the number of warm and hot days was above the long-term average, in Rateče the number of hot days was the fourth highest ever. During the summer 2010 some very intense thunderstorms caused significant damage. The heat wave was observed in July.

Serbia (1)	Above normal	Above normal	Above normal in the northern, below normal in the southern parts, normal in the rest of the territory	Above normal in south and south-eastern parts, normal in the rest of territory	Number of summer days, tropical days and tropical nights was higher than average in most parts of Serbia. In August, maximum number of tropical days (23) was observed at Negotin and Leskovac, which is more than twice as high as the average for this month. The absolute maximum temperatures for June were surpassed on 12 of June 2010 at Kopaonik and Sjenica, with temperatures 25.4ºC and 32.2ºC, respectively. The average minimum temperatures for August were surpassed in 2010 in Negotin (18.5ºC), Kursumlija (14.7ºC) and Dimitrovgrad (14.6ºC). Maximum daily amount of precipitation was surpassed on 19 of June in Kikinda (90.1 mm), on 22 of June in Sombor (113.2 mm) and Novi Sad (67.6 mm) and on 7 of August in Kursumlija (40.4mm). Maximum monthly amount of precipitation was surpassed in 2010 for June in Sombor (240.0 mm), Kikinda (202.6 mm) and Valjevo (216.8 mm) and for August in Novi Sad (168.5 mm). Most parts of Serbia were hit by a heat wave this year, from 7 to 14 of June. A great flood wave on the whole basin of the Kolubara and Jadar was recorded in the period from 23 June to 5 July. New, historical maximum water levels were measured on the river Kolubara at hydrological stations Beli Brod and Draževac and on the river Ub at hydrological station Ub. Major flooding was recorded on the tributaries of the Kolubara: Tamnava and Ljig, on lower part of the Kolubara near Obrenovac, as well as on medium and lower part of the Jadar which caused major material damage.
Turkey (2)	Above normal	Above normal in western and central parts, normal to above normal in eastern and southeastern parts of the territory	Above normal in western part, above normal, within normal in other parts, below normal to normal locally on the south and the east of the territory	Below normal	From the comparison of the average seasonal temperature of 2010 with the past, it appears that the 2010 summer was the hottest one since 1940 on the record. Summer 2010 mean temperature average was 2.2 C° higher than 1971-2000 period. In August 2010, most part of Turkey had positive anomalies especially central part of Turkey. The anomaly of August 2010 temperature ranges from 0.4 C° to 5.2°C. In this period Turkey had warmer condition than normal and 23 centers had new extreme maximum temperature values on record.

Note:
1 - Basic climatological period (1961-1990)
2 - Basic climatological period (1971-2000)
3 - Basic climatological period (1951-2000)
4 - Basic climatological period (1981-2000)
5 – No information about basic climatological period

ANNEX 4

Questions and Answers regarding to CPT and LRF (SEECOF – 4)

Introduction to CPT training (*Simon Mason*, IRI USA; *Emily Hamilton*, UK Met Office)

Question: Is it possible to put more that 5 number of modes?
Answer: It is probably a good idea and I keep it smaller because it is more safety for the system (software)

Question: Are those 1 degree resolution?
Answer: I think it is 2 degree resolution. CPT doesn't tell us how many degrees.

Question:Is there are some constrains of the amount of data?
Answer: No, FORTRAN contain some constrains regarding the number of files, I think 17.000.000 character. Regarding the memory it depends of the power of computer , CPT does no constrains in that sense.

Question: What was the model updated interval?
Answer: I updated every 25, but you can get update every year.
Question: Is it documented in help?
Answer: Yes in the newest version
Question: If there is a trend in input data, could model see it?
Answer: Yes, the model recognizes the trend particularly in rainfall and temperature.

Question: Can correlation seems to be the same for any mod?
Answer: It is written on the top. It is possible to have strong canonic correlation, but it is not possible always to represent the variability of temperature on a perfect way.

Question: Is it possible to extract some data regarding CCA?
Answer: It is theoretically, but it is very difficult. That option is not included because it should allow the possibility for sort of "cheating".

Question: Can we improve the skill of forecast if we conclude that the forecast is not skilled?
Answer: Unfortunately not. We can do something in that sense if the forecast shows extreme results (e.g. extremely low and high temperature), by changing the definition of forecast.

ANNEX 5

An exiting LRF practice in SEE countries

Albania: doesn't issue any long range forecast.

Azerbaijan: issues only monthly forecasts using ECMWF outputs during the flooding period (AMJ).

Federation of Bosnia and Herzegovina, Bosnia and Herzegovina: issues monthly forecasts based on the analogy method. Problems: Sarajevo is the only station with 120 years of continuous records, while other station has significant period with no measurements during 1990s. Within the SEECOF process the CPT and RCM-SEEVCCC model outputs were also taken into account.

Republic of Srpska, Bosnia and Herzegovina: doesn't issue seasonal forecasts, but often asked by some companies to give an opinion on GCMs outputs.

Bulgaria: issues seasonal forecasts using all available materials on the internet, i.e. probability maps from different GPCs (NCEP, MetOffice, ECMWF, IRI, Tokyo, Beying, IBIMET (Italian Institute of Biometeorology) etc) and MetOffice's NAO index forecast. All forecasts are subjectively analyzed. This method is being used since 2007. Problems: low skill of GCMs in the region, MetOffice forecast based on NAO index not available for public anymore (use of CPT may overcome this problem).

Croatia: issues monthly and seasonal forecasts using ECMWF outputs since 2010. Verification and validation is done for temperature and precipitation within 7 regions in the country. Before 2010 the analogy method was used. Their experience is that endusers were more satisfied with analogy method forecast. There are several commercial users of monthly forecasts: gas and electricity companies, road maintaining company, military, world ski cup, etc, while only user of seasonal forecasts at the time is a gas company. Problems: with media interpreting different seasonal forecasts from the internet, endusers don't understand the concept of probabilistic forecast. There is a plan to use RegCM for dynamical downscaling of seasonal ECMWF products.

FYR of Macedonia: doesn't issue seasonal forecasts.

Georgia: issues only monthly forecasts based on the analogy method. During the SEECOF process they have looked at GCMs (ECMWF, IRI, Russia), but they didn't find good agreement with observations due to the complexity of the region.

Greece: issues only medium range forecasts using ECMWF outputs. Participate in COSMO project and will run a regional model for seasonal forecast.

Israel: issues seasonal forecasts using CPT and GCMs, only for precipitation. Problems: low skill of GCMs, problems with GPCs websites.

Moldova: doesn't issue seasonal forecasts. Uses Romanian forecast, but it has low skill in this region.

Romania: issues seasonal forecasts using ECMWF outputs and statistical models(multi-field analog prediction using climate state vector, NAO index forecasts based on sst in May and April-October snow cover extent). Statistical models' forecast is used only for research purpose, not presented to public. Problems: interface with users, presenting the forecast to the public within ethical constrains.

Serbia: issues seasonal forecasts using GCPs (ECMWF, EUROSIP, IRI) and regional coupled climate model RCM-SEEVCCC. Dynamical downscaling of ECMWF seasonal forecast using RCM-SEEVCCC is done for entire SEECOF region and products are available to public via website in a form of monthly and seasonal maps of ensemble mean precipitation, temperature, sst and their anomalies. Problem: still no model's climatology (for the regional model).

Turkey: without comments.

General conclusion: if any activity is done related to long range forecast it mainly involves ECMWF products.

ANNEX 6

Fourth Session of
SOUTHEASTERN EUROPE CLIMATE OUTLOOK FORUM (SEECOF-4)
November 22-26, 2010, Belgrade, Serbia

SEASONAL OUTLOOK FOR WINTER SEASON 2010/2011 FOR THE SOUTH EASTERN EUROPE AND CAUCASUS REGION (SEE&C)

Under the overall coordination of WMO and the South East European Virtual Climate Centre (SEEVCCC), hosted by Republic Hydrometeorological Service of Serbia, SEECOF-4 was held in Belgrade, Serbia, from 22 to 26 November 2010. Representatives from fourteen National Meteorological and Hydrological Services of Southeast Europe and Caucasus region, namely Albania, Azerbaijan, Bosnia and Herzegovina, Bulgaria, Croatia, Georgia, Greece, Former Yugoslav Republic of Macedonia, Israel, Moldova, Montenegro, Romania, Serbia and Turkey participated in the implementation of SEECOF-4.

Climate experts from WMO RA VI Pilot RCC Network Nodes on long-range forecasting (Meteo France, France and Roshydromet, Russia) and on climate monitoring (Deutscher Wetterdienst, Germany), UK Met-Office, Global Producing Centre ECMWF, International Research Institute for Climate and Society (IRI, USA), National Centers for Environmental Prediction (NCEP,USA), South East Europe Virtual Climate Change Centre (SEEVCCC, Serbia) and National Hydrometeorological Services of SEECOF region provided their valuable contribution to the successful implementation of SEECOF-4 by developing the relevant documents and providing scientific guidance and recommendations.

The SEECOF-4 comprised the following Steps:

- Step 1: qualitative verification of the SEECOF-3 climate outlook for Summer 2010;
- 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 winter season 2010/2011.

All relevant documentation is posted and updated on SEEVCCC web site:

http://www.seevccc.rs/?p=705

SEECOF- 4 CONSENSUS OUTLOOK
FOR WINTER SEASON 2010/2011

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

Amongst the large scale modes of variability expected to influence the southeastern European climate this winter are North Atlantic sea-surface temperatures and Eurasian snow cover extent. For both, the values observed recently are most commonly associated with non-zonal flow over Europe during winter. Also, La Niña conditions currently established in the tropical Pacific and predicted to continue beyond winter are likely to have a similar effect on the large scale circulation over the area of interest. In addition, several general circulation models concur in predicting a seasonal pressure pattern with positive anomalies over the eastern North Atlantic, impeding development of zonal flow over the continent.

The consequences for temperature and precipitation vary across the region due to local factors. The maps show the probabilistic consensus forecast for tercile categories of anomalies of seasonal-mean temperature and precipitation, relative to the period 1971-2000.

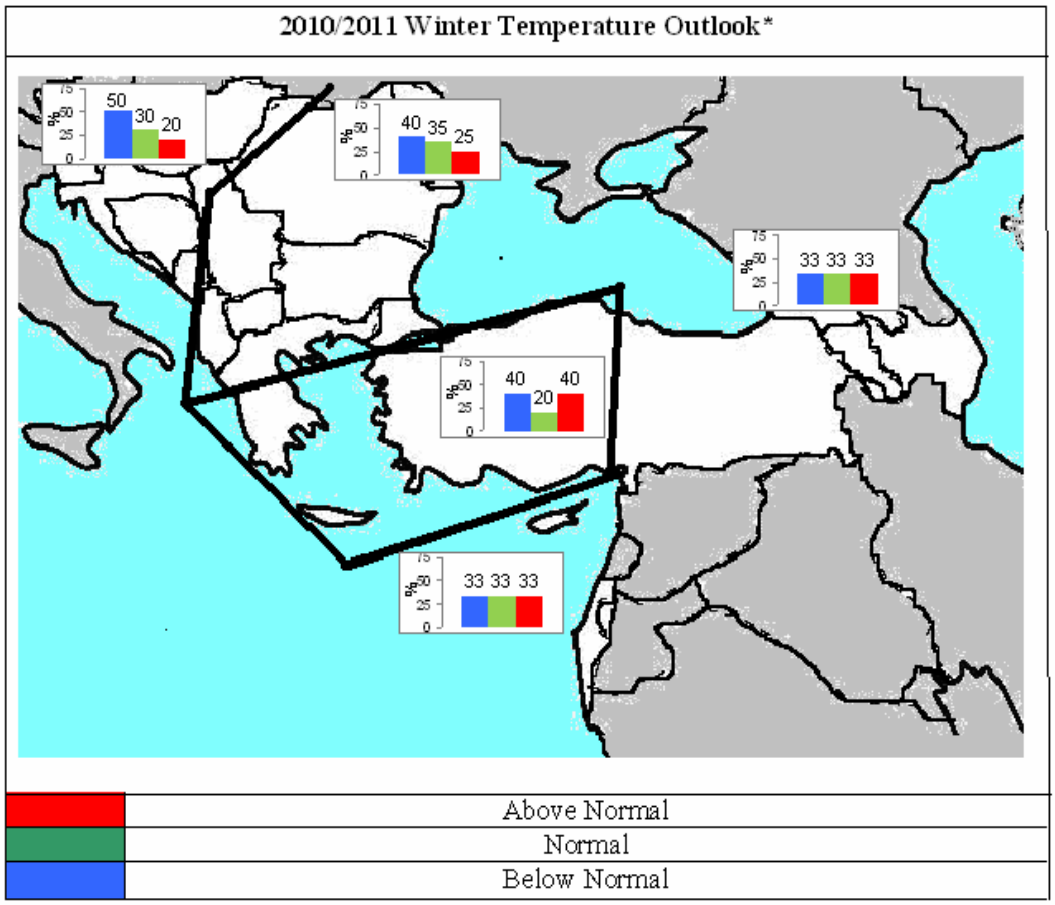

Figure 1. Graphical presentation 2010/2011winter temperature outlook

In summary, there are higher probabilities for below-average than for near – or above – average temperatures in the northwestern part of the region. The

prediction uncertainty increases towards the southeast. For the southern and eastern regions of the domain (see Figure 1) there is currently no predictive signal.

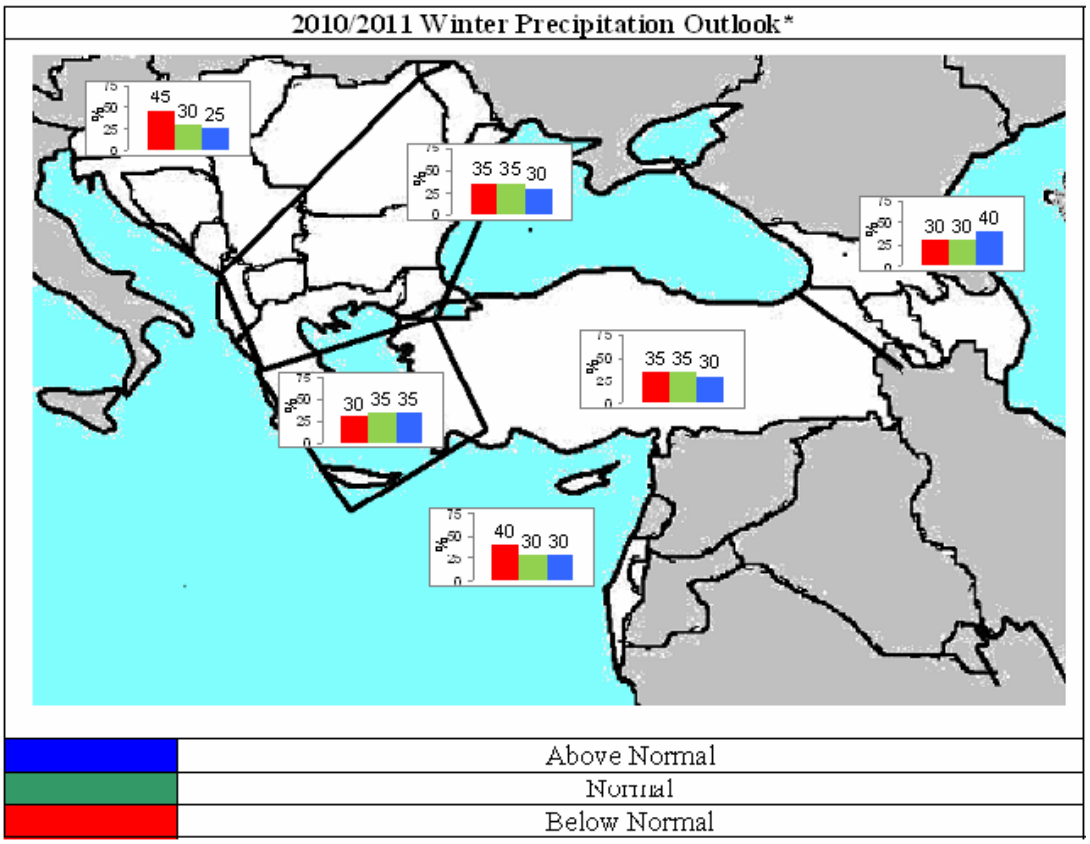

Figure 2. Graphical presentation 2010/2011 winter precipitation outlook

Uncertainties in regional predictions are larger for precipitation than for temperature. In summary, current indications are for a slight shift towards drier-than-average conditions in the northwestern and southern parts, and towards wetter-than-average conditions for eastern and southwestern regions. It must be emphasised that even in the event of seasonal totals below the long-term average, shorter wet spells of heavy precipitation, possibly snow in places, are still possible, especially given the predicted large-scale atmospheric circulation.

Any further advice on the forecast signals, 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.

** 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.*

APPENDIX A: Contributors to SEECOF-4

- World Meteorological Organization
- Met Office, United Kingdom
- International Research Institute for Climate and Society, United States of America
- European Center for Medium Range Weather Forecast
- Meteo France, Republic of France
- Federal Service for Hydrometeorology and Environmental Monitoring, Russian Federation
- Deutscher Wetterdienst, Federal Republic of Germany
- National Centers for Environmental Prediction, United States of America
- South East European Virtual Climate Change Center hosted by Republic Hydrometeorological Service of Serbia, Republic of Serbia
- Institute for Energy, Water and Environment, Republic of Albania
- Armenian State Hydrometeorological and Monitoring Service, Republic of Armenia
- National Hydrometeorological Department, Republic of Azerbaijan
- National Institute of Meteorology and Hydrology, Republic of Bulgaria
- Meteorological and Hydrological Service, Republic of Croatia
- Hellenic National Meteorological Service, Greece
- Meteorological Service, Republic of Cyprus
- The National Environmental Agency of Georgia, Georgia
- Meteorological Service of the Republic of Hungary, Republic of Hungary
- Israel Meteorological Service, State of Israel
- Republic Hydrometeorological Institute, Former Yugoslav Republic of Macedonia
- State Hydrometeorological Service, Republic of Moldova
- Hydrometeorological Institute of Montenegro, Montenegro
- National Meteorological Administration, Romania
- Federal Hydrometeorological Service of the Federation of Bosnia and Herzegovina, Federation of Bosnia and Herzegovina, Bosnia and Herzegovina
- Republic Hydrometeorological Service of the Republic of Srpska, Republic of Srpska, Bosnia and Herzegovina
- Republic Hydrometeorological Service of Serbia, Republic of Serbia
- Meteorological Office, Republic of Slovenia
- Turkish State Meteorological Service, Republic of Turkey

WORLD METEOROLOGICAL ORGANIZATION
Fourth Session of the
Southeastern Europe Climate Outlook Forum (SEECOF-4)
22-26 November 2010, Belgrade, Serbia

MEETING EVALUATION FORM

- Thank you for participating in SEECOF-4!
- Your feedback and suggestions are hereby summarized.
- The appraisal of the various aspects of the meeting is indicated next to each item listed below on the scale 1 to 5, ranging from a poor rating (1) to an excellent rating (5).
- The specific comments are noted on the bottom of this sheet.

№	Item of Evaluation	Rating
1	Overall meeting organisation (format, structure, etc.): please specify on the verso.	4.7
	Part A: Pre-COF: Capacity building & generation of the climate outlook (22-24/11)	
2	Overall quality of the introductory session (introduction of the work plan)	5
3	Technical Presentations and inputs	4.5
4	Helpfulness of information on technical aspects	4.7
5	Interactive Discussion	4.4
6	**Guidance on Practical sessions**	**4.2**
7	Helpfulness of practical sessions	4.6
8	Consensus development process	4.5
9	Discussion of country presentations	4.8
10	Helpfulness of country presentations	4.4
11	Overall outcome of the Pre-COF session	4.3
	Part B: SEECOF-4 Session: Consensus Outlook & User Interaction (25-26/11)	
12	Overall quality of the opening ceremony (duration, the key-notes)	4.9
13	Technical and Overview Presentation	4.7
14	**Helpfulness of information presented**	**3.8**
15	Interactive Discussion	4.4
16	Discussion of user presentations	4.5
17	Helpfulness of users presentations	4.8
18	Presentation of SEE climate outlook for the winter season	4.7
19	Overall SEECOF-4 outcome	4.7

Note: *The technical & logistic support has been well appreciated. It was also mentioned that the distribution of data before the training session would have been improved the overall quality of the session.*