Fourth Session of
SOUTHEASTERN EUROPE CLIMATE OUTLOOK FORUM

SEECOF-4 MEETING

ANALYSIS AND VERIFICATION OF SEECOF-III CLIMATE OUTLOOK FOR 2010 SUMMER SEASON FOR SOUTHEASTERN EUROPE (SEE)

CLIMATE OUTLOOK FOR 2010 SUMMER SEASON FOR SEE REGION

As stated in the SEECOF-III Seasonal Climate Outlook for 2010 summer season over Southeastern Europe Consensus Statement (document http://www.wmo.int/pages/prog/dra/eur/SEECOF-3-page5.php). "Summer 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". Climate outlook for 2010 summer season for SEE region is presented in Figure 1.

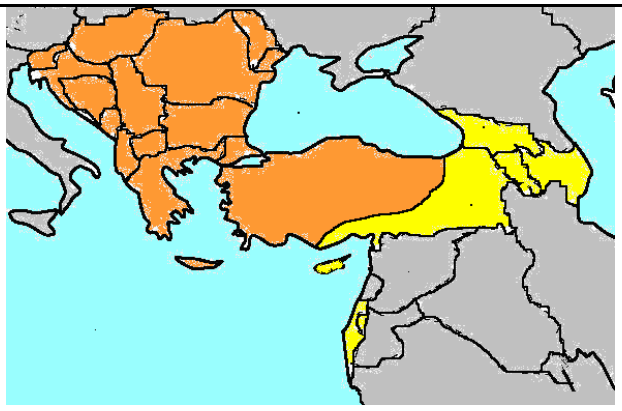
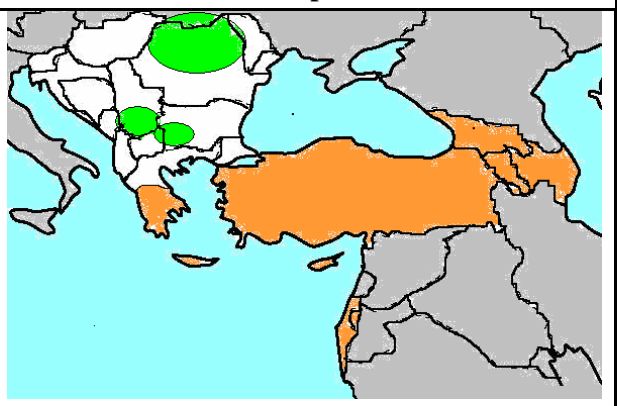
2010 Summer Temperature Outlook		2010 Summer Precipitation Outlook	
			
	Above Normal		Above Normal
	Normal		Normal
	Below Normal		Below Normal

Figure1. Graphical presentation of climate outlook for 2010 summer season for the SEE region

SHORT ANALYSIS OF THE 2010 SUMMER SEASON FOR SEE REGION

Analyses of the summer season temperature and precipitation anomalies 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/Bosnia and Herzegovina, Croatia, Cyprus, Georgia, Greece, Hungary, Israel, Former Yugoslav Republic of Macedonia, Republic of Moldova, Slovenia, Serbia and Turkey (documents available from http://www.seevccc.rs/SEECOF/SEECOF%20IV-STEP1/

Summer mean temperatures in the lowlands of the SEECOF area mostly ranged between 20°C and 25°C, in some southern and eastern parts above 25°C, at some higher elevations, below 20°C. Absolute maximum temperatures were near to 40°C in many parts of the area, in the south above. Nicosia in Cyprus they reached 45.6°C on 1 August, the highest value since the beginning of the 20th century. Also, the nights were warm, the number of tropical nights were higher than normal in many parts of south-eastern Europe. Summer was warmer than normal over almost whole Europe, and so was also the SEECOF area. Anomalies were above +1°C over almost the whole area, locally above +2°C and even above +3°C in its north-easternmost parts. Summer season temperatures are presented in Figure 2 (left panel).

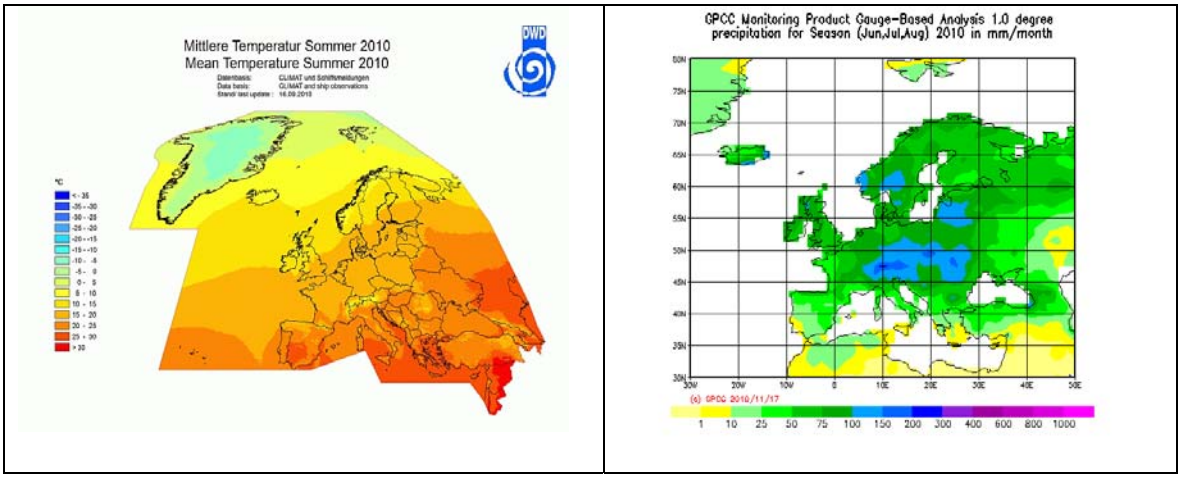


Figure 2. Summer season 2010 observed temperatures (left panel) and summer season observed precipitations in mm per month (right panel). Source: http://www.dwd.de/ecsm

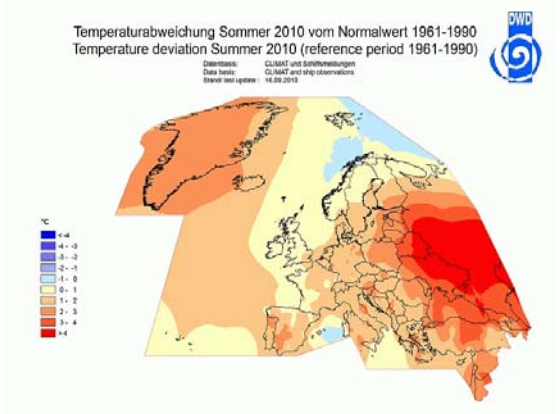
The high positive anomalies were mainly due to a long and strong heat wave in July and in August to a persisting blocking high with its centre over Russia, but also affecting south-eastern Europe and the south Caucasus region. All the three summer months were warmer than normal; highest anomalies mostly occurred at the end of the season. Summer season temperature anomalies are presented in Figure 3 (left panel).

The summer precipitation totals over the SEECOF area ranged from less than 10 mm in southern Turkey, Cyprus and Greece (as per Climate monitoring report of NHMS of Israel, there was totally dry) up to more than 200 mm in the north, locally even much more. Summer season precipitations are presented in Figure 2 (right panel).

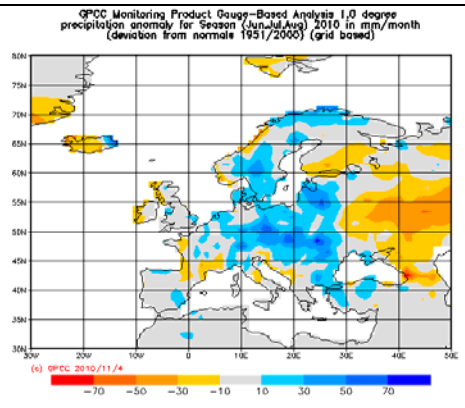
Precipitation anomalies were very diverse within the SEECOF area. It was considerably wetter than normal (>125% of the long-term average) particularly in northern and eastern parts of south-eastern Europe and over the most of Turkey. In contrast, it was mostly dry in the south Caucasus region (especially in Georgia) and near the Adriatic and Mediterranean coasts.

It was particularly wet over almost the whole SEECOF area in June with much convective rain, except in Slovenia, Cyprus, Israel and the south Caucasus. In July, most parts near the Adriatic Sea became dry, but also Israel, southern Greece and parts of Turkey. August was very dry in almost the whole SEECOF area except the north.

Especially the northern Balkan peninsula was affected by some heavy rain events in June. At the beginning of June, a quasi-stationary upper tropospheric low caused intense precipitation, e.g., in Hungary and in Bosnia and Herzegovina. Severe thunderstorms with heavy rain and partly with hail were recorded in the middle of June in Slovenia, Hungary, Bulgaria and Turkey. At the end of June, heavy rain caused severe flooding in northern and eastern Romania and in Moldova, but also in Bosnia and Herzegovina. In July, there was still some heavy rain in the north of the SEECOF area, e.g. in Slovenia and in Moldova. Turkey has observed some local heavy rain event in June. Summer season precipitation anomalies are presented in Figure 3. (the panel on the right).



Product prepared and supplied by the according EuCLIS-Member



Product prepared and supplied by Deutscher Wetterdienst

Figure 3. Summer season 2010 observed temperature anomalies (left panel) and summer season observed precipitation anomalies in mm per month (right panel). Source: http://www.dwd.de/ecsm

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, sub-regional 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 precipitation	
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 the above mentioned period, the mean daily temperature was above normal by 5-7^0C on July 14-16, intensive 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 weather 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	Below normal	Strong positive (extreme) temperature anomalies occurred over all the country. Average temperature over the country was 4-6^0C, on 5 June, Baku city station recorded even 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,

			highlands and foothills areas.		August forest fires occurred in some parts of the country. The acriculture sector suffered from drought. Intensive rainfall was observed in the country only in the first part of June and caused strong floods in the whole country.
Federation of Bosnia and Herzegovina, 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-western part, normal for the remaining part of the territory	No comment
Croatia (1)	Above normal	Above normal	Above normal in the north-eastern part, normal for the remaining part of the territory	Normal	No comment
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 August when maximum and minimum temperatures were about 2 to 8^{o}C above normal. Nicosia reached 45.6^{o}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-	Below normal	In June, a number of extreme events occurred, such as flashfloods, hail, storms that is usually characteristic for June.

			western part, normal to below normal in the rest of the territory		They caused damage of buildings, roads, in some cases, agriculture and harvest were almost totally destructed, on 23 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 the 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.
Former Yugoslav Republic of Macedonia (1)	Above normal		Above normal in the north and north-eastern parts, below normal over the other part of the territory	Normal in greater part, above normal in the east of the territory	No comment

Republic of Moldova (1,3)	Above normal	Above normal	Above normal in the north and southern parts, normal in the rest of the territory	Normal	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 years. Especially hot and also dry was from 1 August until 16 August. So, the average air temperature for the first decade of August was 24.4-27.6 ºC, 4.3-5.5 ºC below normal and on major parts of the territory it is observed for the first time during the whole period of instrumental measurements. Maximum air temperature of 35°C and more, reached during the summer season, lasted 17 days (SM Tiraspol). This is observed once in 20 years and the norm is 2 days. The amount of precipitation 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. On the contrary, in August, on the most of the territory, a significant rainfall deficit - 9-40 mm or 20-70% of the monthly norm was observed. 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, unfavorable influence of grain crops harvest.
Montenegro		Above normal		Normal	

Romania		Above normal		Above normal in the northern parts, normal in the rest of the 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	The number of summer days, tropical days and tropical nights were 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 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 the 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: the Tamnava and the 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 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 parts 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