

# Assessment of the seasonal forecast for the winter season 2013/14 in Armenia

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14 April 2014, Armenia

## Temperature

**December:** The temperature throughout the country was below normal by 1-10 degrees. Average monthly air temperature; in mountainous areas:  $-5 \dots -14^{\circ}\text{C}$ , in the foothills:  $-2 \dots -8^{\circ}\text{C}$ , in the foothills of Ararat valley:  $-8 \dots -9^{\circ}\text{C}$ , in the northern lowlands:  $0 - 1^{\circ}\text{C}$ , in Ararat valley  $-6 \dots -7^{\circ}\text{C}$ .

The weather at the beginning of December (1-3) was relatively warm. During this period the highest maximum temperature was observed. In mountainous areas, temperatures rose to  $+2 \dots +9^{\circ}\text{C}$ , in the foothills:  $+6 \dots +15^{\circ}\text{C}$ , in lowland areas:  $7 \dots +15^{\circ}\text{C}$ .

At the end of the day on December 3rd, an intrusion of cold air from the Urals moved over the territory of Armenia, resulting in a drop of nighttime air temperatures by 5-10 degrees.

On December 8<sup>th</sup>, a second wave of cold air from an arctic trough moved over the Northern Caucasus's and the Black Sea, then rounding the Caucasian ridge from west and east, the cold air mass surrounded the territory of Armenia. Snow was observed throughout Armenia, with some locations receiving significant amounts of accumulation. Snow blanketed the entire country.

From the 11th to the 14th of December, Armenia was under the influence of a Mediterranean cyclone. Throughout Armenia, precipitation was observed as snow and significant accumulations in particular locations. Another cyclone progressed eastward through Armenia on the 14<sup>th</sup>.

After this event, no precipitation was observed for the remainder of the month. An anticyclonic pressure system prevailed at surface levels from the 17th of December to the end of the month. This circulation brought warm air masses from European and Russia territories.

Armenia has mountainous terrain and some areas have their own orographic features; for example, Ararat valley and its foothills are located in a basin, surrounded by mountainous ridges on the west, north, and east. Resulting radiative cooling and in the presence of snow cover had it enhanced cooling of air temperatures. Warm air moving from the northwest was not able to displace the cold air from the basin, but only passed over top of this region. A significant inversion formed at the surface to 3 kilometers, with air temperatures dropping 10-15 degrees. Land surface air temperatures continued to drop and fog, weak snow, and frost was observed in the Ararat valley, its foothills, Meghri, and Gyumri. Other regions in Armenia were unaffected by this inversion and observed clear conditions.

The lowest minimum and maximum air temperature was observed during the 25<sup>th</sup>-31<sup>st</sup> of December in the Ararat Valley and surrounding foothills. There was no significant difference in day and night time temperatures during this period. The night air temperature dropped to  $-19 \dots -22^{\circ}\text{C}$  in Ararat valley,  $-24^{\circ}\text{C}$  in Gyumri, and the day time temperatures did not rise above  $-10 \dots -14^{\circ}\text{C}$ . The average daily temperature during this period was below normal by 13-16 degrees.

After the 10<sup>th</sup> of December, radiation and advective fog was observed with visibility of 50-500m. In the first decade of December, local winds increased to 15-18 m/s, some gusts reaching 20-25 m/s. Observations at Pushkin Pass showed sustained winds of 24m / s with gusts of 40 m / s.

**January:** The average monthly temperatures in most parts of Armenia were above the normal temperatures by 2-3 degrees except Ararat Valley; observed 1-1.5 degree below normal. The mean monthly temperature in the northern lowlands observed  $+0.6 \dots +2.5^{\circ}\text{C}$ , in the southern lowland  $+0.9 \dots +1.1^{\circ}\text{C}$ , in Ararat valley  $-4.1 \dots -4.5^{\circ}\text{C}$ , in the foothills  $-1.0 \dots -3.1^{\circ}\text{C}$ , and in the highlands  $-2.9 \dots -10.2^{\circ}\text{C}$ .

The coldest days were in the first and second decades of the month when the temperatures in mountainous areas fell to  $-22 \dots -27^{\circ}\text{C}$  ( $-28 \dots -30^{\circ}\text{C}$  in Ashotsq), in the foothills  $-11 \dots -18^{\circ}\text{C}$ , in the northern lowlands  $-8 \dots -10^{\circ}\text{C}$ , and in Ararat valley  $-16 \dots -18^{\circ}\text{C}$ . During this period, anticyclonic pressure field near the surface in Armenia established overcast weather. With the presence of snow cover over most of Armenia, there was intensive radiative cooling during the night, resulting in drastic decreasing minimum air temperatures.

In the third decade, cyclonic activity intensified over the Mediterranean region and progressed over the Caucasus. These pressure systems brought warm moist air masses to Armenia. Most regions in Armenia observed sometimes significant, rainfall. Mountainous and foothills regions observed snow while lower elevations observed rain. Day and night air temperature increased substantially throughout the country. The mean daily temperature in the third decade was above normal by 5-10 degrees. Above zero temperatures were observed over the entire region of Armenia.

Localized winds were observed in the presence of a significant pressure gradient at given altitudes. Warm air from the southeast increased to 15-16 m/s, with gusts up to 18-23 m/s. Radiation fog was predominately observed over Armenia during the month with visibility of 50-500 m.

**February :** An anticyclonic pressure system prevailed over the region giving way to stable weather conditions for the month. Precipitation occurred at the beginning and the end of the month due to the passage of the cold front associated with a southern cyclone over the territory of Armenia. Average monthly temperature in most parts of Armenia were above the normal by 1-4 degrees and in other regions, temperatures remained near normal; in mountainous regions -3 ... - 8°C , in the foothills -3 ... +2° C, and in the lowlands +1 ... +4° C.

The lowest temperature recorded in the first decade was the 3rd - 6th of February. Minimum temperatures in northern mountains and foothill areas dropped to -25 ... - 30°C (Ashotsq reached - 39°C ), Ararat valley dropped to -12 ... - 14°C, in the valleys of Syunik -11 ... - 14°C. Mean daily air temperatures during this period were below normal by 7-12 degrees.

Decreasing temperatures were due to the passage of a cold front on February 1st. The cold front descended from the north in the southern periphery of an anticyclone that surrounded the Greater Caucasus mountain range from the west and east; similar to the December 8<sup>th</sup> event. Radiative cooling caused a further decrease in temperatures. Northwesterly flow was observed at higher altitudes during this period.

The highest temperature was observed during the third decade. Maximum air temperatures rose in mountainous areas to +4 ... +11° C, in the foothills +10 ... +14° C, in the lowlands +14 ... +17°C (Northeast of the Syunik valleys: +20 ... +22° C). Average daily air temperature during this period exceeded the average multiyear temperature by 5-7 degrees. Zero precipitation was observed in Armenia during this time. This warm air mass moved into the Armenian region from the southwest. The beginning of the second decade marked a transition of above freezing average daily temperatures (0°C) in the foothills and lowlands.

Strong winds were observed primarily in the second decade of the month. The average wind speed was 15-17 m/s, with gusts reaching 20-23 m/s.

During the first and third decades, locations affected by fog had visibility of 100-500m. On February 17, various station's visibility decreased to less than 50 m .

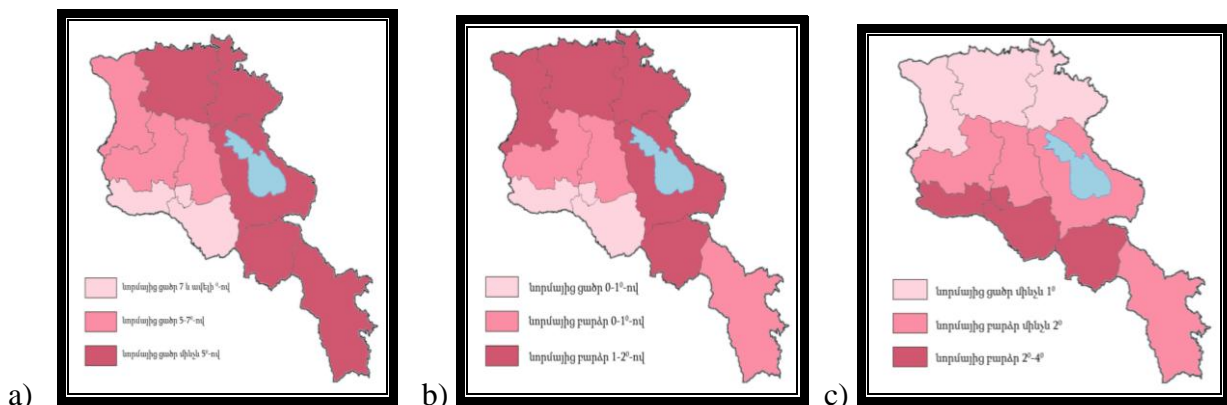


Figure 1. Temperature anomaly: a) December, b) February, c) January

**Verification of the SEECOF-10 winter 2013/2014 Temperature outlook for Armenia**

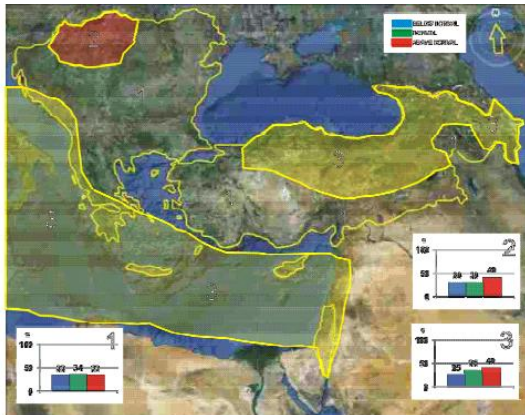


Figure 1. Graphical presentation of the 2013/14 winter temperature outlook

Figure 2. SEECOF-10 outlook for temperature

According to the SEECOF-10 outlook (Fig. 2):

For the cold season, the average temperature was projected to be 25% lower than the norm; 35% near the normal and 45% likely to be above the norm.

The actual data for season average temperature in Armenia was near the norm in the Ararat valley but below by 1-2 degrees.

Observed temperatures in December were very cold. The temperature was below the norm by 2-5 degrees; in Ararat valley 7-8 degrees. In January the temperatures were above norms by 1-2 degrees; Ararat valley was below the norm by 1-2 degrees. In February the temperature was higher than the norm by 1-3 degrees.

Verifying this temperature outlook, the seasonal forecast for mean temperature was not expressed properly for Armenia.

**Precipitation**

**December:** Most parts of Armenia’s monthly rainfall did not exceed the normal. Precipitation totals were only 36-91% of its normal. Only 13th stations exceeded the normal; 105-210%.

**January:** The amount of precipitation during the month in most mountainous regions, Ararat Valley, and its foothills exceeded the monthly average and amounted to 102-205% of monthly normal. In the Tavoush and Lori was 47-90% and Sunik only reached 21-80% of the monthly average precipitation.

**February:** Monthly rainfall throughout the country had not reached the normal and was 3-78 % of the normal. There was a significant shortfall in precipitation in most regions of Armenia.

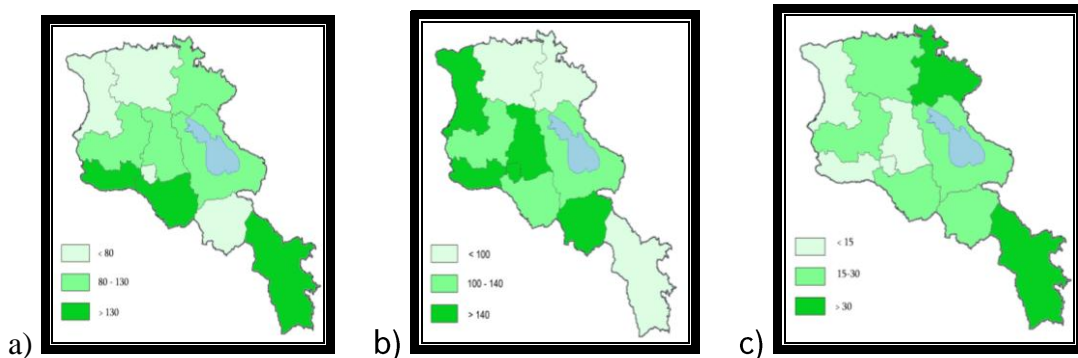


Figure 3. Precipitation anomaly: a) December, b)February, c)January

**Verification of the SEECOF-10 2013/2014 winter precipitation outlook for Armenia**

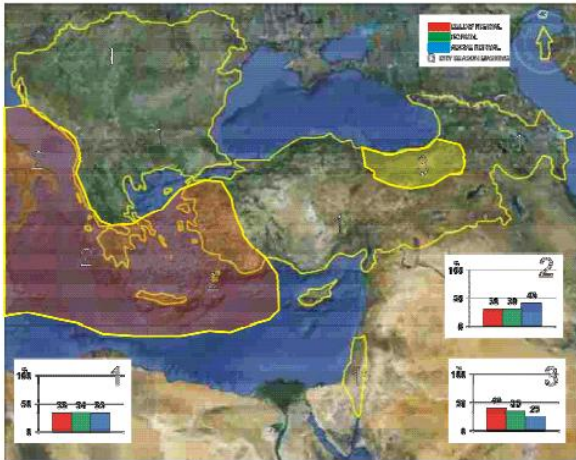


Figure 2. Graphical presentation of the 2013/14 winter precipitation outlook

Figure 4. SEECOF-10 outlook for precipitation

According to the SEECOF-10 outlook (Fig. 4):

Precipitation by SEECOF-10 - in the area during the cold season forecasts predicted a 33% probability normayts low, 34% and 33% likely to be the norm. For Armenia (zone 1) there was no clear signal for precipitation.

The actual rainfall data for January and February was less than the norm, making normal 70-120% in December , 80-170% in January, and 10-40% in February

**Snow cover**

**December:** Snow coverage included most of the county at the end of the month, except in lowland areas of Tavush and Syunik. Snow heights in mountainous areas were within 21-31 cm, in the foothills 18cm, and in the Ararat valley 6-10 cm.

**January:** At the end of January, the snow depth at the Aragats observation station (3229 m elevation) recorded 107 cm, upland areas recorded 2-67cm, and Ararat valley had zero snow coverage.

**February:** At the end of the month, the snow cover was observed only in the mountainous regions. Maximum snow height was observed in Jermuk and Hrazdan with 46 cm depth (81cm at the Aragats observation station).

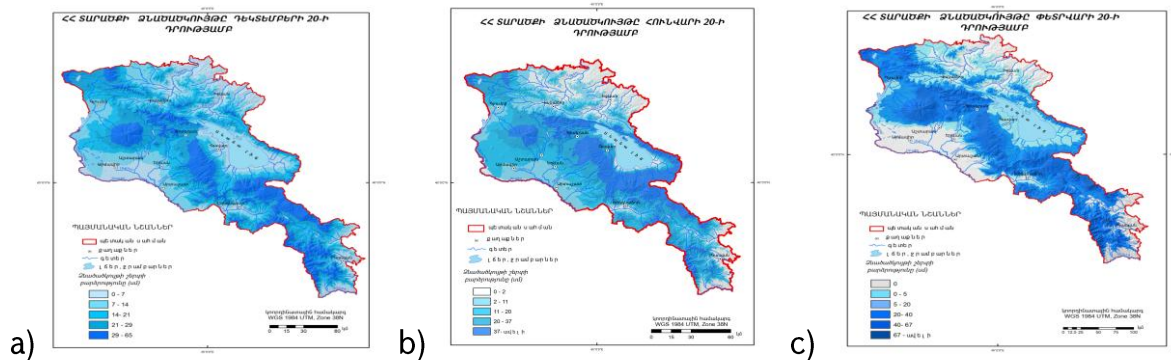


Fig 3.Snow cover: a) December, b) February, c) January

**High Impact Events:**

	Seasonal temperature	Seasonal temperature	Seasonal precipitation	Seasonal precipitation	High Impact Events
	Observed	climate outlook	Observed	climate outlook	
Armenia (1)	normal (Ararat valley below normal)	above normal	Below Normal	Weak indication	December 9th heavy snow in Kajaran December 11th heavy snow was observed in Ararat and Gavar; 32 mm / h 12. January 28th heavy snow was observed in Jermuk 22 mm / 12 h. Some days there were wind of 25-30 m / sec. December fog with poor visibility; 50-500m

The seasonal forecast was not successful for Armenia's winter 2013/14.

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