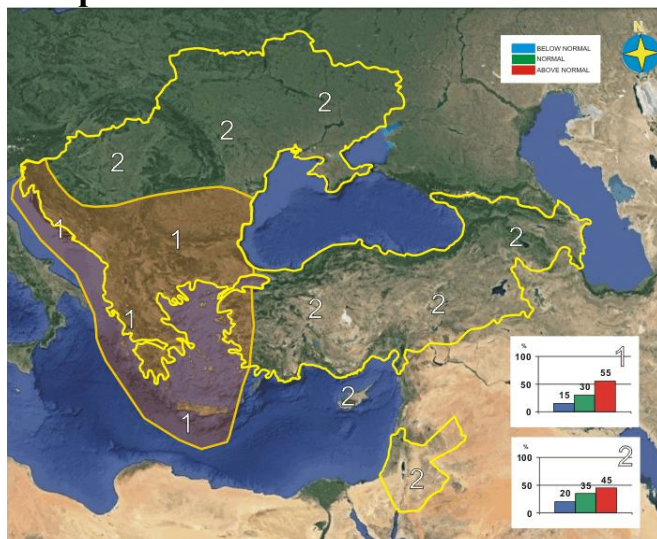


VERIFICATION OF THE SEECOF-14 WINTER 2015-2016 CLIMATE OUTLOOK FOR THE TERRITORY OF UKRAINE COMPARED TO THE 1981-2010 BASE PERIOD

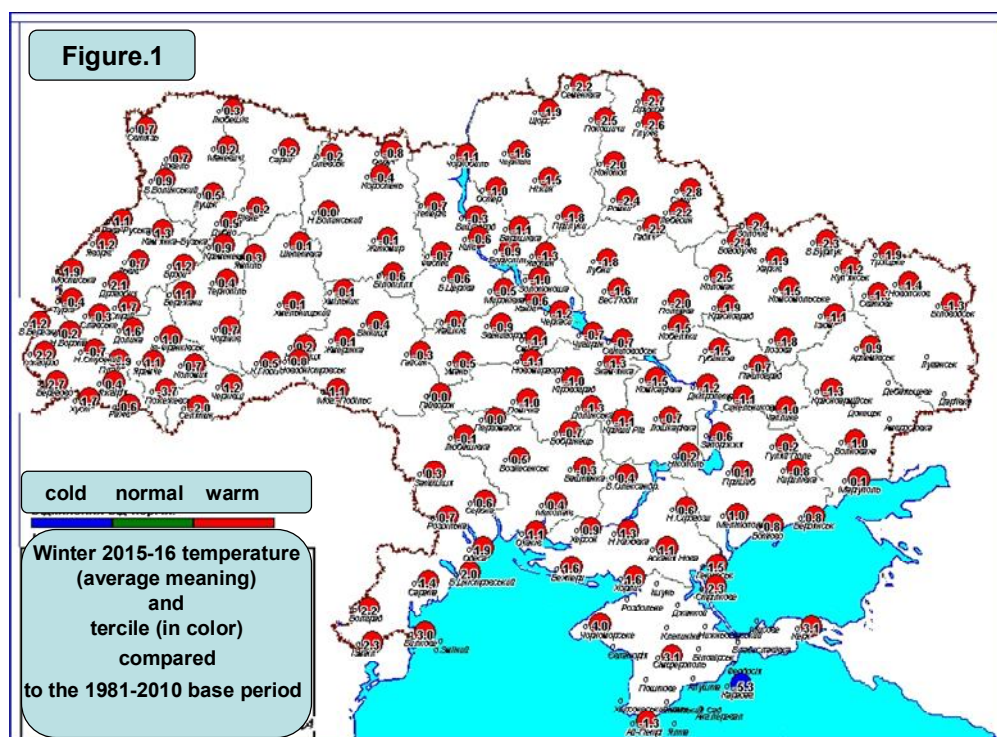
Temperature



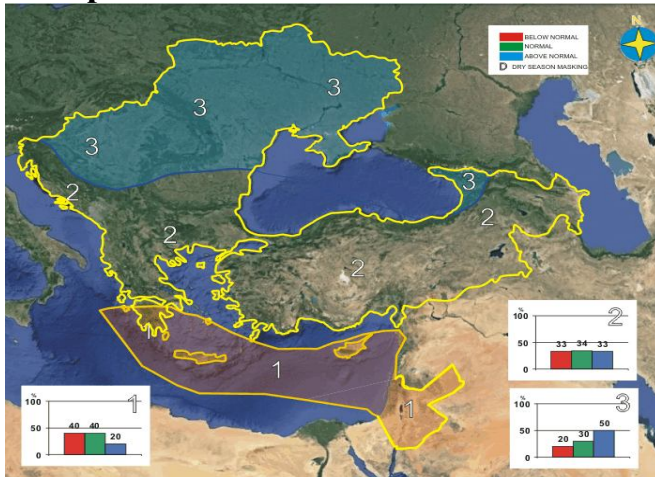
According to the SEECOF-14 outlook for the winter 2015-16 in Ukraine, seasonal temperature in Ukraine was expected warmer (upper tercile) with 45% probability, normal with 35% probability and below (low tercile) with 20% probability, compared to the 1981–2010 climatological base period.

Climatological monitoring showed that the the winter 2015-16 was warm in Ukraine with above normal temperature based on the tercile method (*Figure 1*).

The outlook for a warm winter was correct. Verification showed that the temperature reached upper tercile which was indicated in the outlook with the 45% probability.

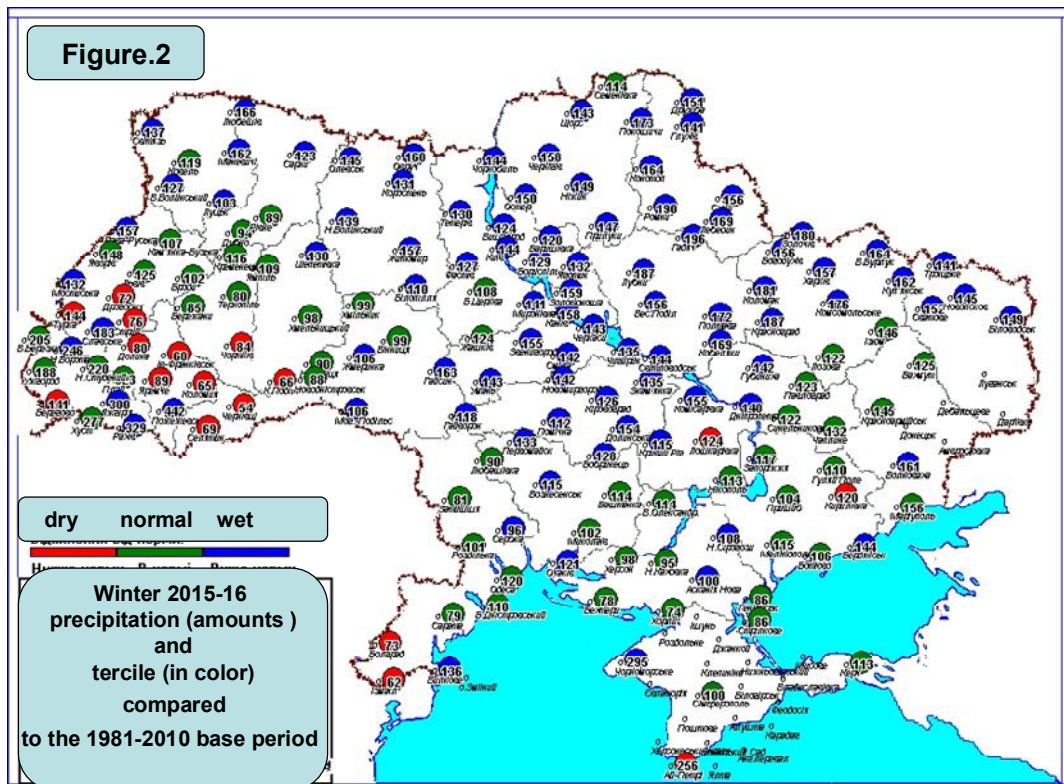


Precipitation



The SEECOF-14 climate outlook indicated the probabilities for below (20%), for near (30%) and for above (50%) normal conditions in whole Ukraine.

Monitoring of precipitation showed normal and wet winter conditions across the entire country, only in the west and south parts were places which dry conditions based on the tercile method with 1981–2010 climatological base period (*Figure 2*).



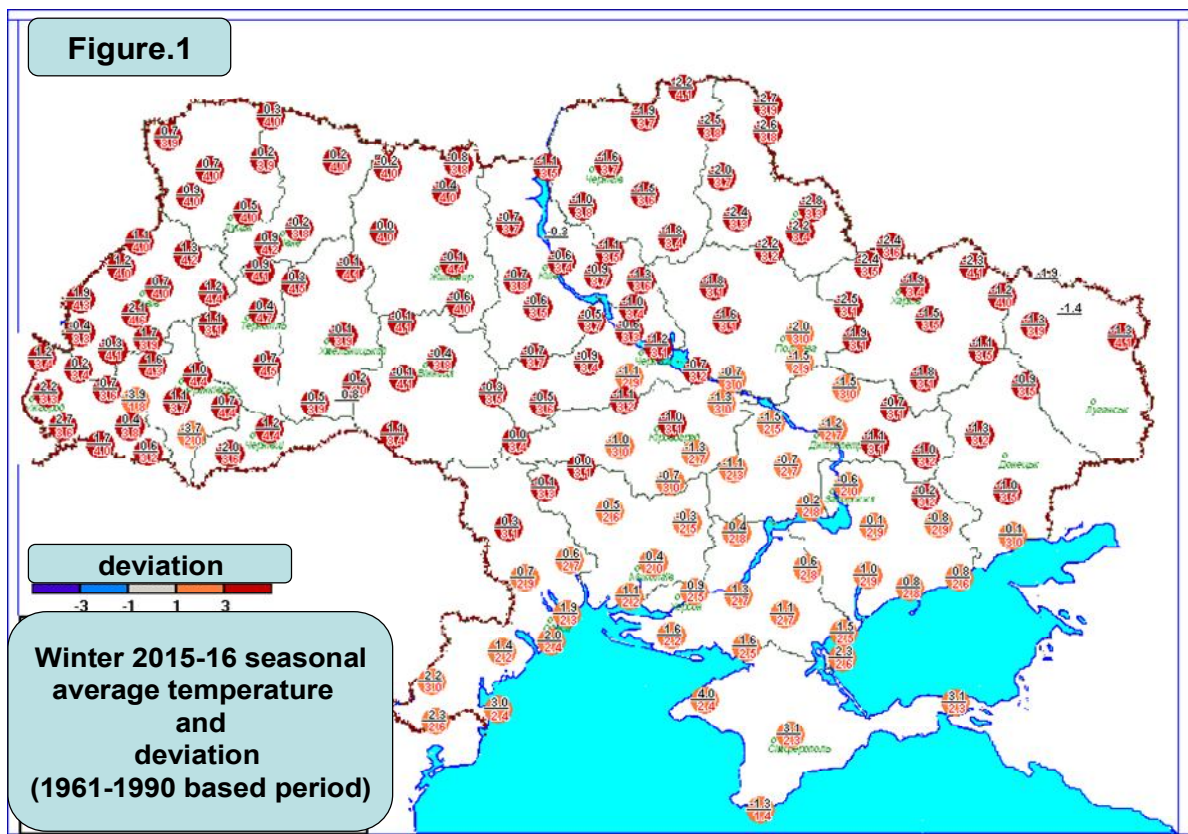
The SEECOF-14 climate precipitation outlook for winter 2015-16 was justified in most of the territory of Ukraine.

Analysis of the 2015-2016 winter season for Ukraine compared to the 1961-1990 base period

Temperature

The average seasonal temperature ranged from $-2,8^{\circ}\text{C}$ in the north-east of the country (Sumy region) to $+3,0^{\circ}\text{C}$ in the south-west (Odessa region), in the Crimea to $+4,0^{\circ}\text{C}$, in the Carpathians mountains (highlands) $-3,7..-3,9^{\circ}\text{C}$.

Deviation of the mean air temperature from the normal, was $2..3^{\circ}\text{C}$, in north part $3..4,7^{\circ}\text{C}$ above the climate norm (1961-1990) (Figure 1).



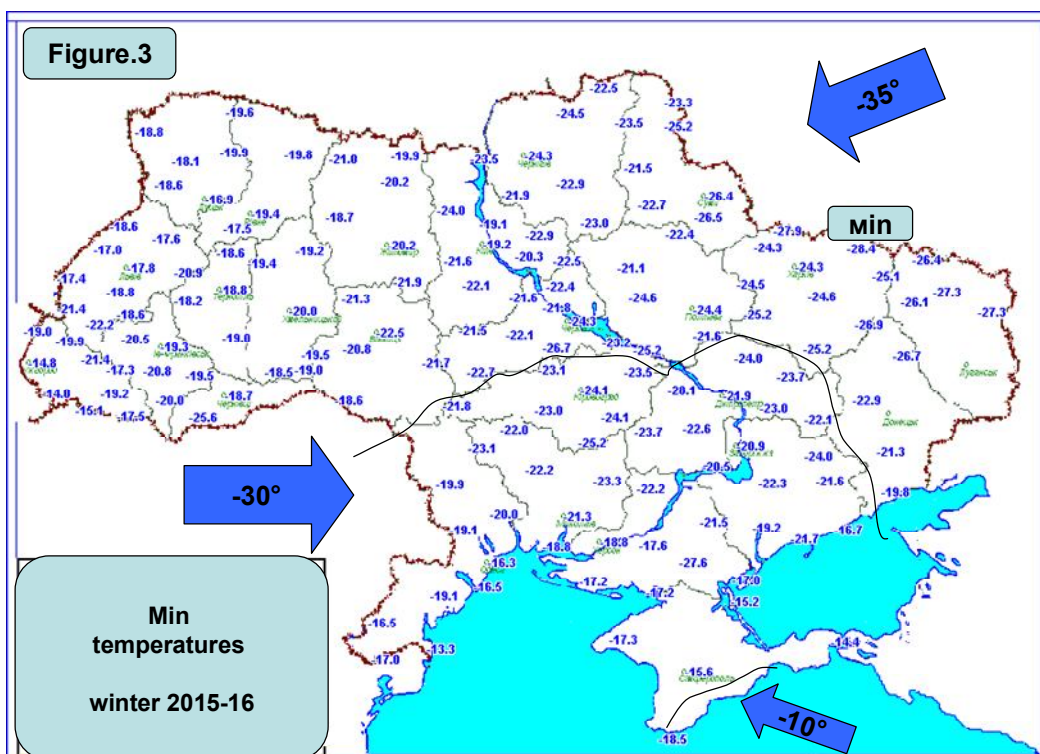
According to the tercile method (with 1961–1990 climatological norm), mean air temperature during winter was in the warm category.

Maximum temperature was in the range from $+8.7^{\circ}\text{C}$ in Sumy region (north-east) to $+22,7^{\circ}\text{C}$ (Izmail 23.02.2016) in the south of Odessa region (south-west), in Carpathian mountains (highlands) $8,7..10,1^{\circ}\text{C}$ (Figure 2).



The minimum temperature ranged from -13.3°C in the south of Odessa region to -28.4°C (Velukiy Burluk 25.01.2016) in the north of the Kharkiv region. (Figure 3).

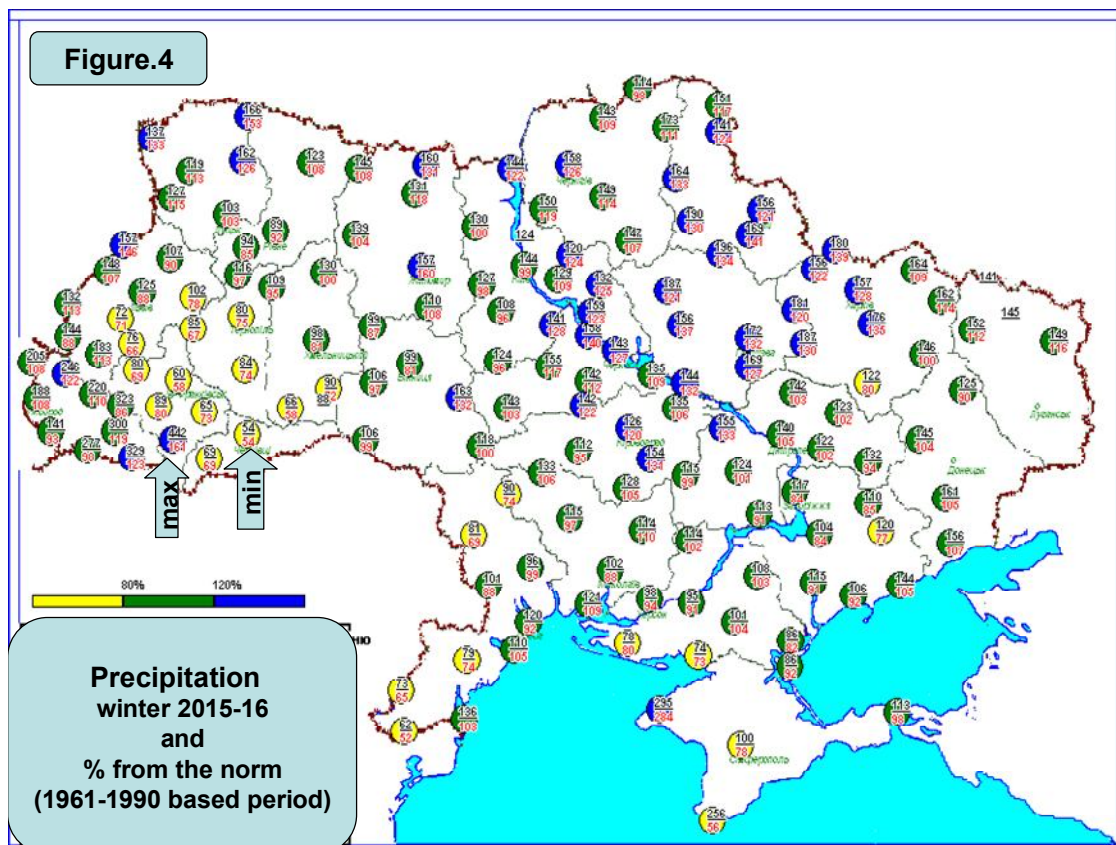
Throughout the winter has not been reached criteria for severe frost (-30° and -35°C) in Ukraine.



Precipitation

Seasonal precipitation was in most regions of the country close to normal (80-120%) and ranged from 86 mm (south of Kherson region) to 173 mm (north of Chernihiv region); in some places in northern, western and central part of the country was excess of precipitation 120-442 mm (120-161%), in the Crimea 295 mm (284%), in the Carpathian highland region 323-442 mm (86-161%), in some places west and south part marked deficiency of precipitation 60-102 mm (52-80%) (Figure 4).

Most of the winter precipitation fell in January (7-9 and 17-19th) during the two cyclonic processes from the south.



The biggest daily precipitation was recorded January 12th at Pozhezhevska (Carpathian highland) and there was also recorded continuously (from 10th to 16th January) precipitation (rain and snow) with the amount 186 mm as a result.

According to the tercile method (with 1961–1990 climatological norm), precipitation during winter was in the normal and wet category, in some places of the western and southern part was dry category.

From month to month winter 2015-16 was not homogeneous. Weather conditions were different as day by day and month by month.

In winter 2015-16 was only one wide distribution disaster, that caused significant damage to the economy of Ukraine, another fixed strong disasters had a local character. Brief description of the variations of monthly indicators presented below.

December was abnormally *warm and dry*. Zonal transfer of air masses was broken three times meridional from the northwest and northeast.

The average month temperature was 0-4°C below zero, it was 1.5°C above the climate norm (Figure.5 (A)).

Precipitation were 20-77% of the month norm, in some places Odesa, Mykolaiv, Kherson, Kirovohrad and Chernivtsi regions 1-19%, in Behtery (Kherson region), Odessa, Sarata and Izmail (Odesa region) not fallen at all (it was driest month for the entire observation period), only in most parts of Chernihiv, Sumy regions (north-east) and some places in Volyn, Rivne region (north-west) fell 80-120%, in Kharkiv 124% of the month norm (Figure.5 (A)).

Very dangerous weather phenomenon was December 1-3 in Kharkiv region (heavy snow 21-23 mm/10-12 hours, snow cover 10-17 cm).

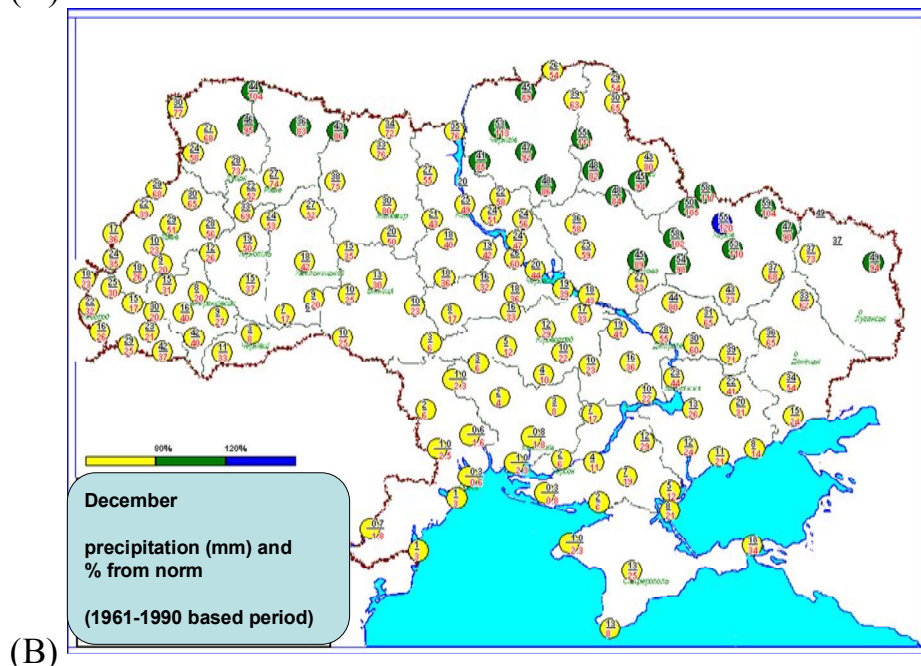
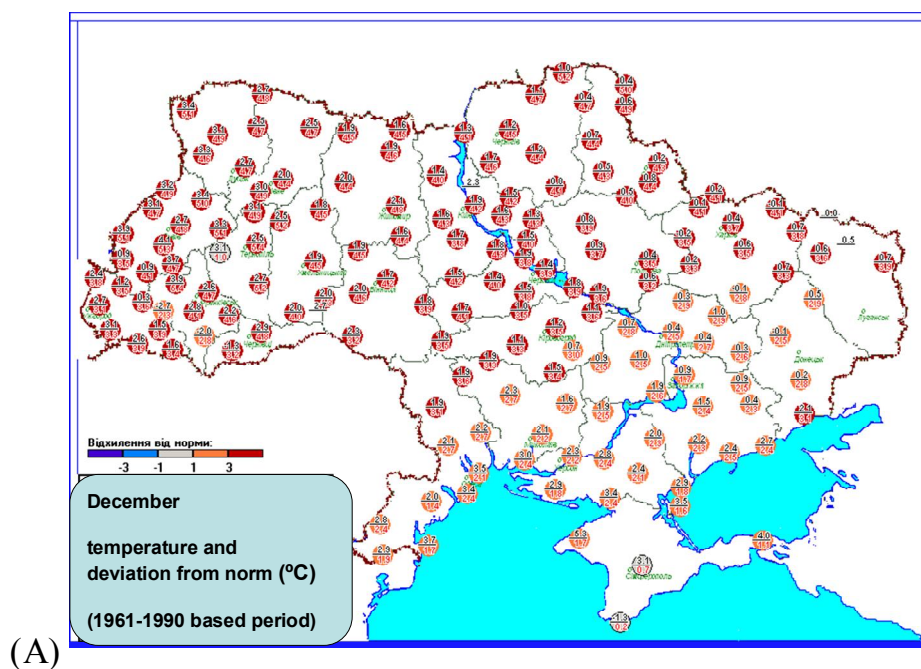


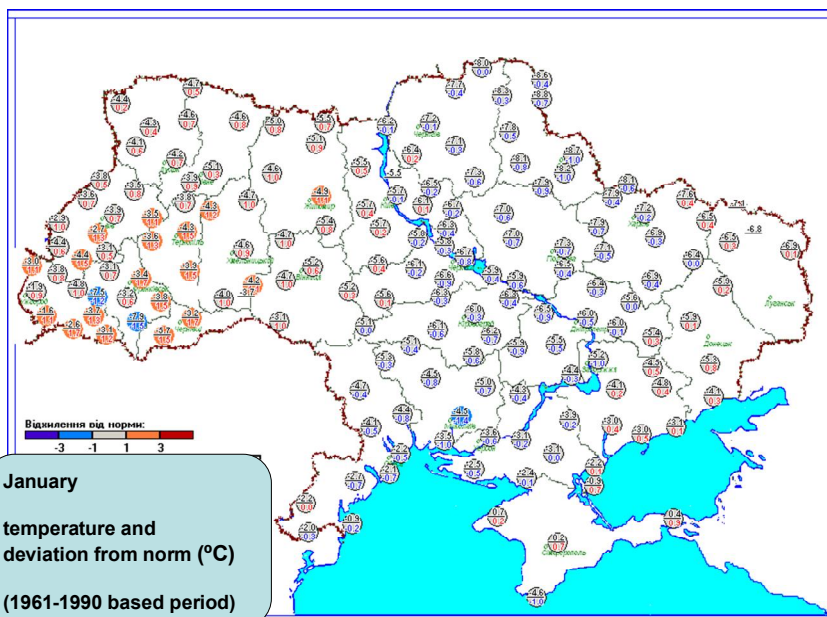
Figure.5 Average monthly temperature (A) and precipitation (B) in December

January was *wet and normal* (with big fluctuation of daily temperature).

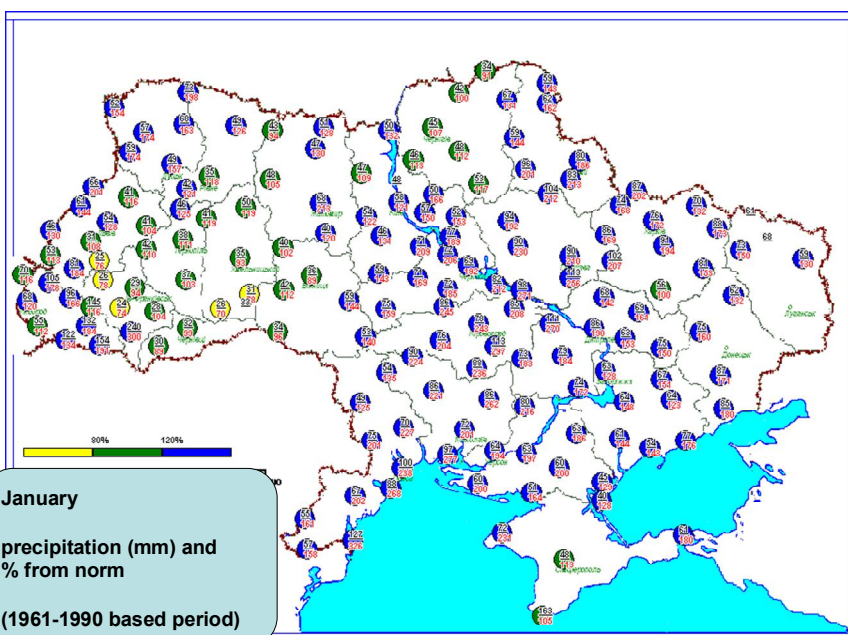
Two periods of very cold weather (January 1-5 and 21-25) with arctic air from north-east and north, two cyclone periods from south (January 7-9 and 17-19), in the rest time was prevailing zonal movement of air masses with abnormally warm weather.

The average monthly temperature was close to normal in most regions of the country (Figure.6 (A)). Precipitation was from 1 to 3 monthly norm (Figure.6 (B)).

Very dangerous weather phenomenons were January 17-18: heavy snowfall (20-39 mm/6-12 hours, snow cover 10-35 sm) in Dnepropetrovsk, Kirovograd, Odessa, Poltava, Kharkiv regions; strong blizzards (wind speed 15-24 m/s during 12-29 hours) in Dnipropetrovsk, Kirovograd, Mykolaiv, Odesa, Poltava regions, in Ust-Danaysk (Odessa region) wind speed was 25-27 m/s; strong ice covering with diametr of sediments 21 mm was in Kherson.



(A)



(B)

Figure.6 Average monthly temperature (A) and precipitation (B) in January

February was one of the *warmest* for the entire period of observation, in some areas of western and southern parts of country it was the warmest, month was *not uniform in moisture*.

Prevailed latitudinal movement of air masses, which in the second decade was broken meridional from south and south-west. As a result, the average daily temperature exceeded the norm from 4 to 9°C, on some days – 10..14°C.

The average monthly temperature exceeded the norm by 5..8°C (Figure.7 (A)). The Maximum temperature was 8..17°C, in the eastern, southern areas, in the Carpathian and Vinnytsia region to 21°C, in the south of Odesa region to the of 23°C.

Precipitation is normal, in some places in eastern, southern, Ternopil and Chernivtsi regions 51-79% (in the south of Odesa 13-48%) from the norm (Figure.7 (B)).

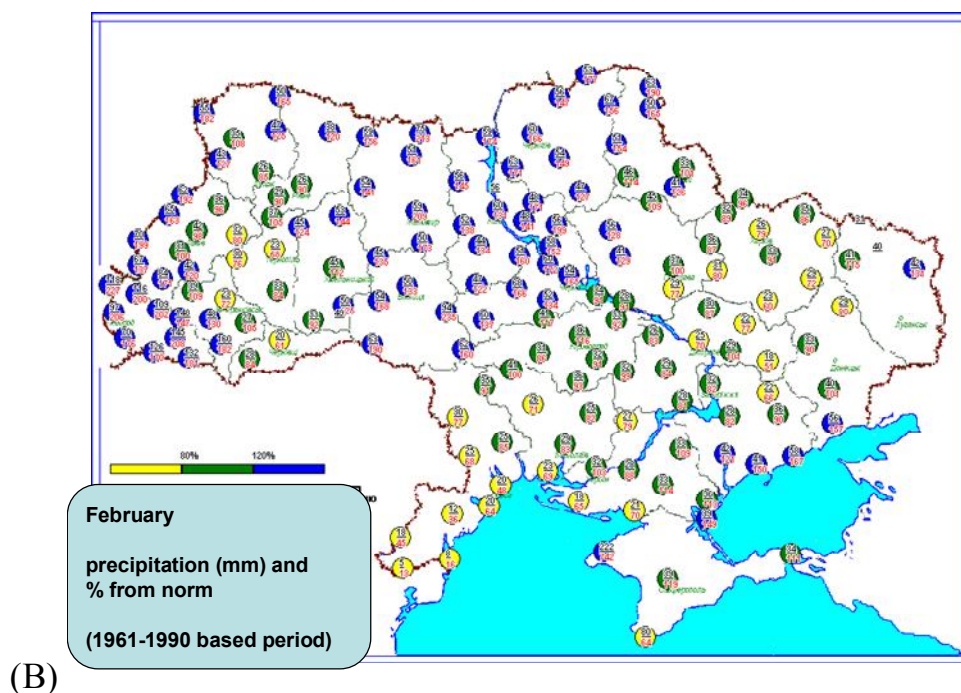
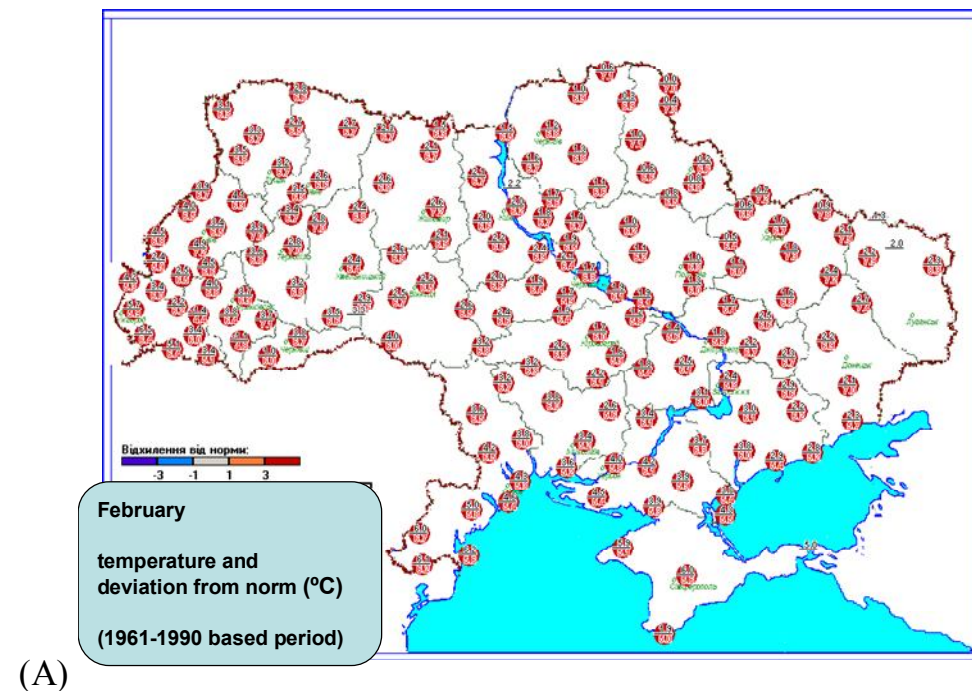
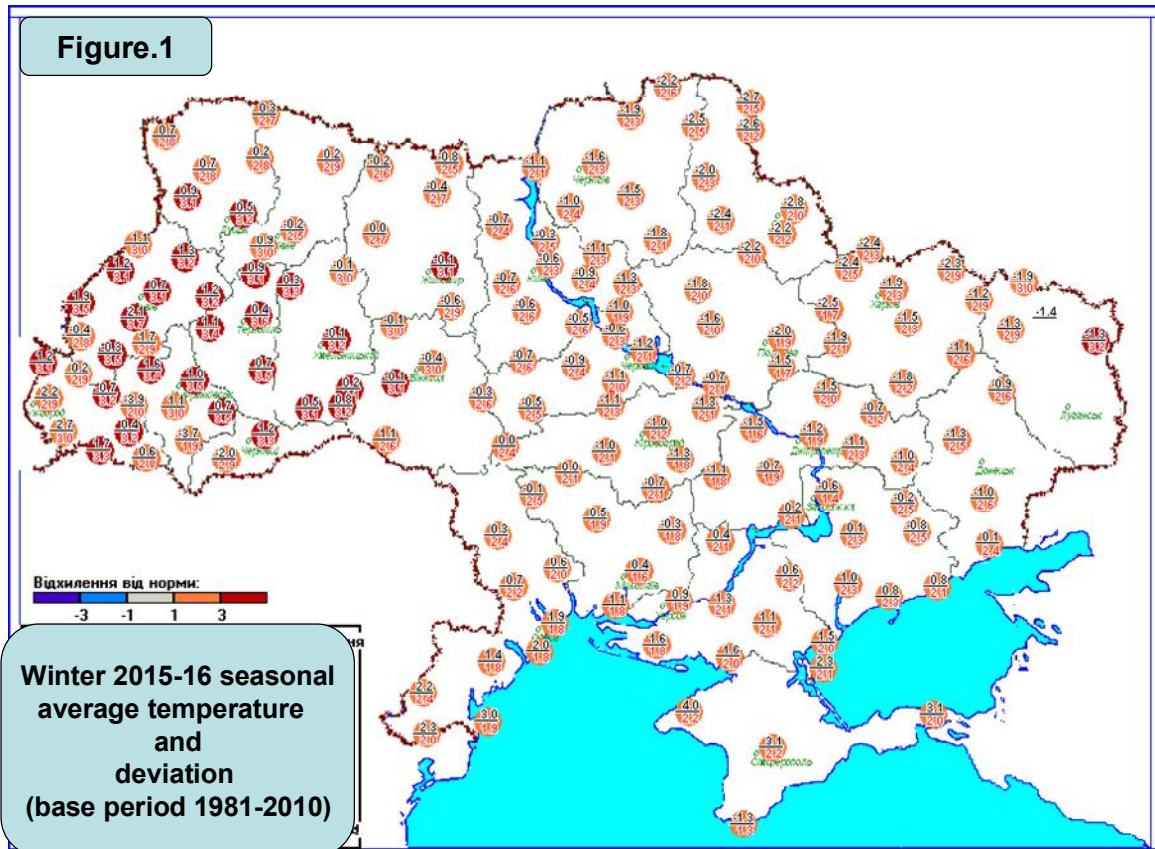


Figure.7 Average monthly temperature (A) and precipitation (B) in February

Analysis of the 2015-2016 winter season for Ukraine compared to the 1981-2010 base period

Temperature

The mean air temperature during winter 2015-16 was 2..3°C, in the west part of the country to 3,6 °C above the average values of the 1981-2010 base period (Figure.1).



From month to month temperature deviation was not homogeneous.

In December recorded *anomaly positive deviation* 3..5,2°C in most of Ukraine, only in the south parts of the country and some places of Carpathian 1..3°C (Figure.2 (A)).

In January there were *negative deviations* 1...3°C in most of Ukraine. In the west of the country prevailed small negative deviation 0...1°C and in the north-est were places with anomaly negative deviations 3..4,2°C (Figure.2 (B)).

In February fixed *anomaly positive deviation* 4...7,3°C for the whole country (Figure.2 (C)).

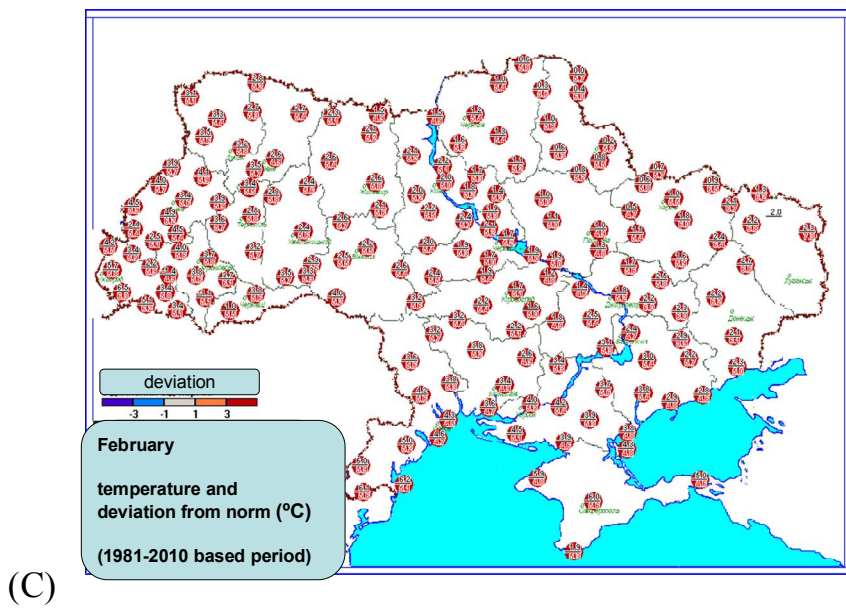
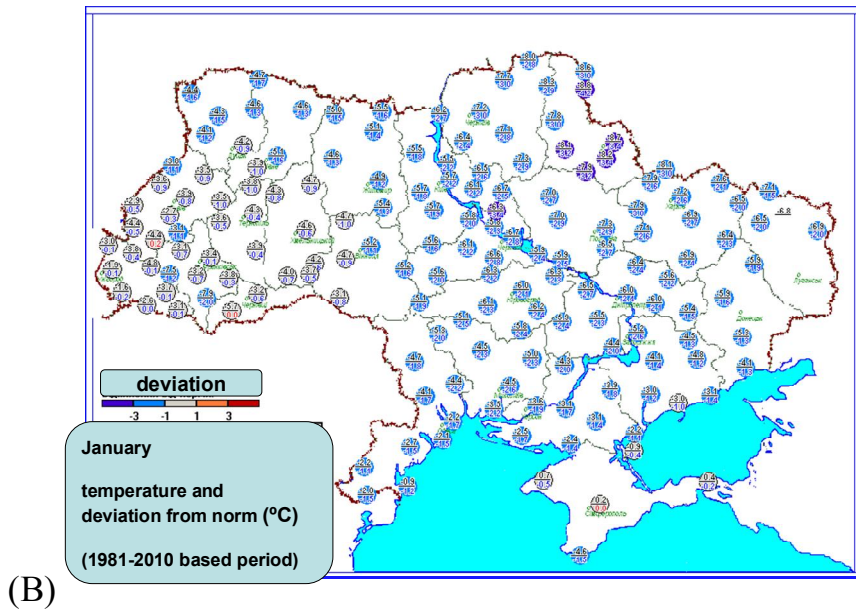
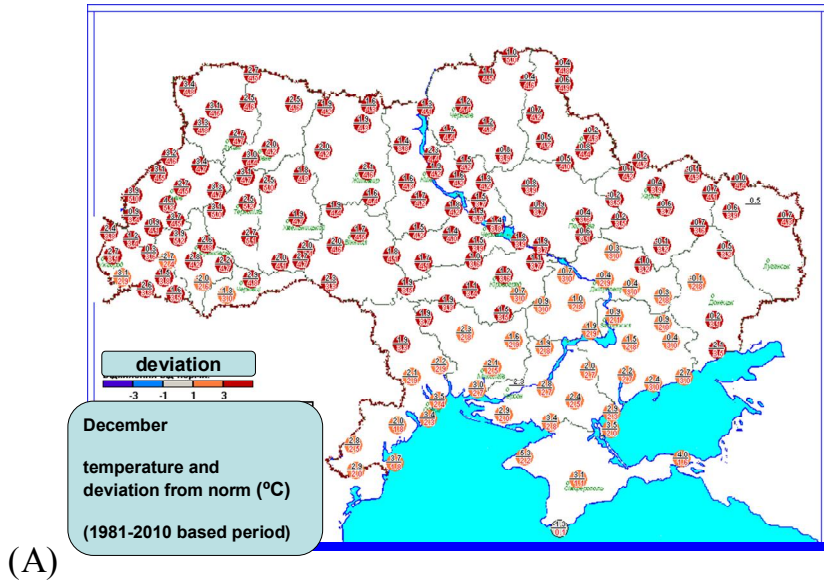
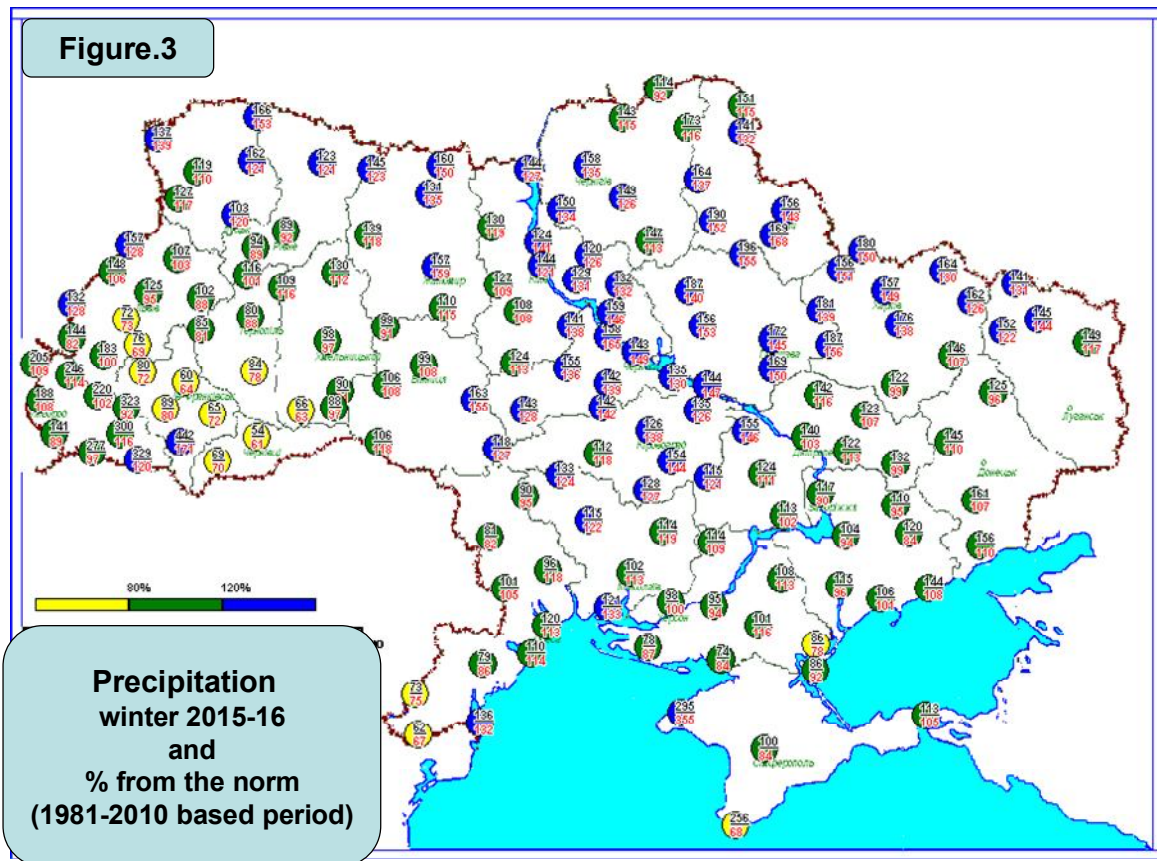


Figure.2 Average monthly temperature in December (A), January (B), February (C)

Precipitation

Generally in winter 2015-16 was dominated normal and excess moisture 80..171% from the average values of the 1981-2010 base period, also there was dry (60..80%) places in the west and the south of the country (Figure.3).

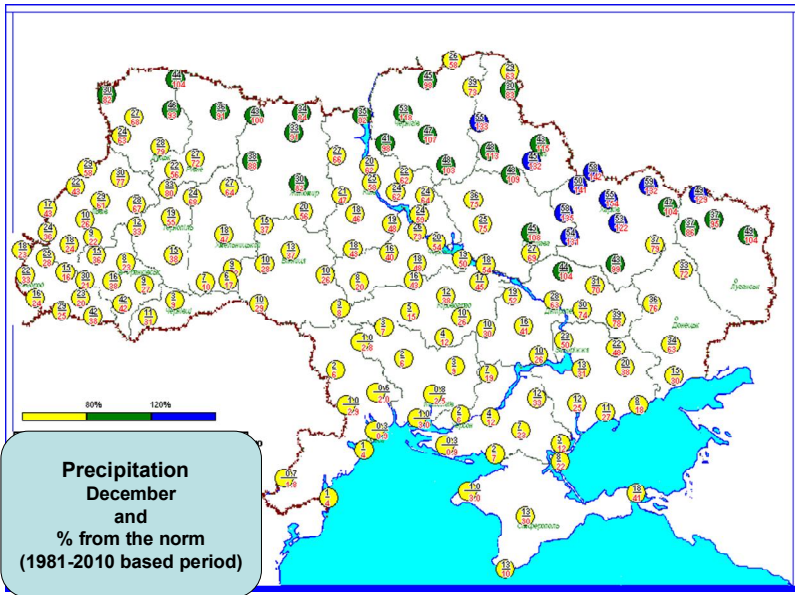


From month to month winter precipitations was not homogeneous.

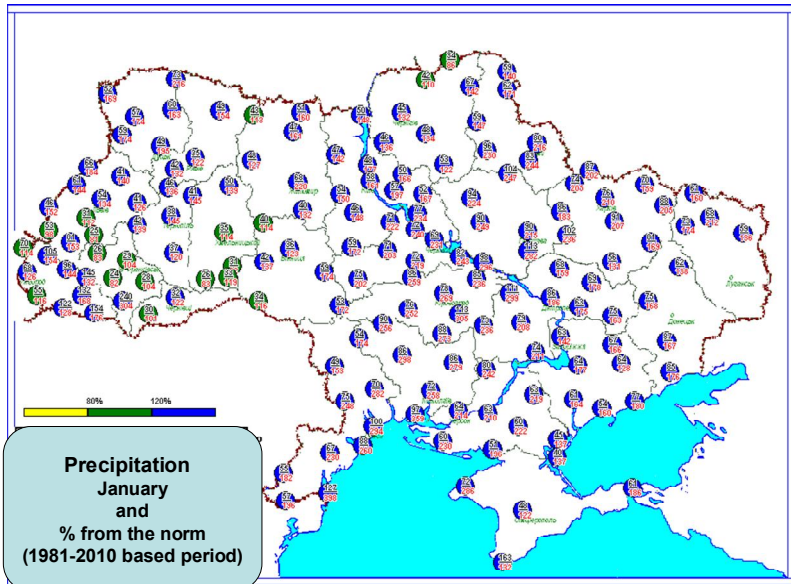
December was *anomaly dry* (15..70%) in most part of Ukraine, in some places in the south-west was 1..10%, only in the north and north-east were places with normal and excess (80...154%) precipitation (Figure.4 (A)).

In **January** was radically another situation, it was *very wet*. In most of the country was excess precipitation (120 ...400%) and normal (80..120%) in some places in the west and north.

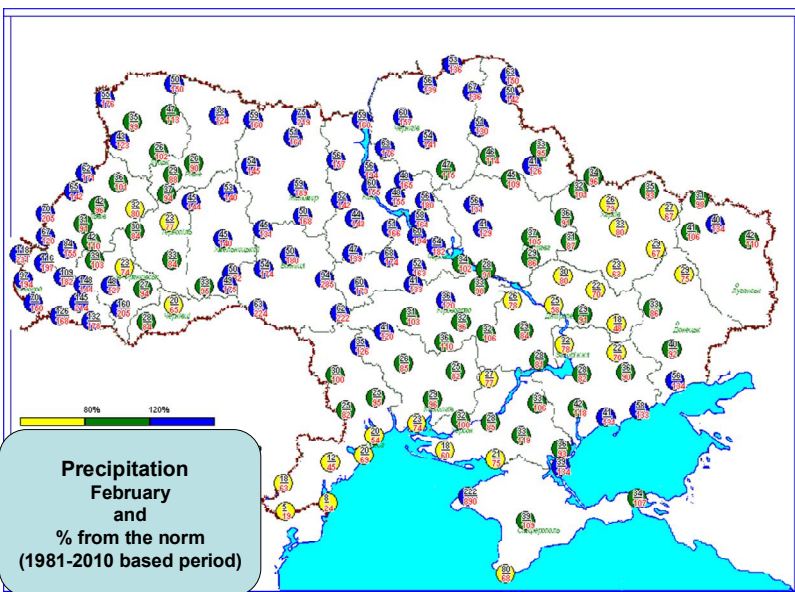
In **February** precipitation have irregular distribution of the area and range *from dry to excess moisture*, but in the most of the country 100..231% from the average values of the 1981-2010 base period.



(A)



(B)



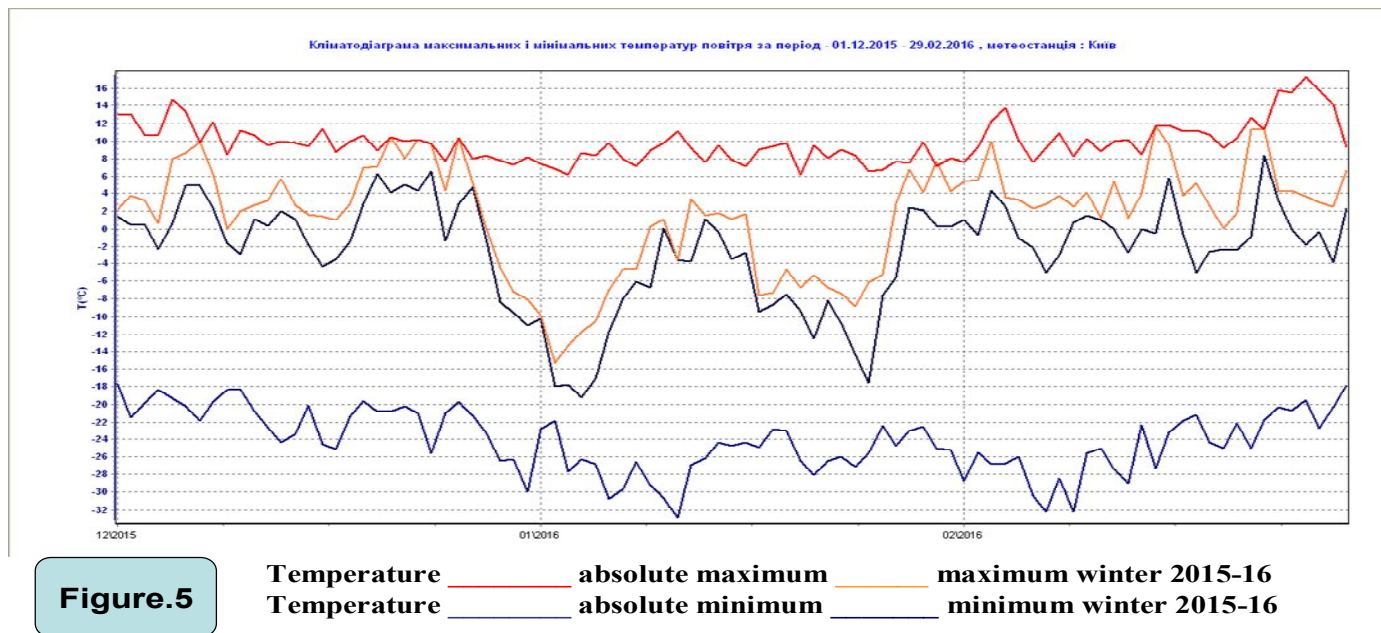
(C)

Figure.4 Precipitation in December (A), January (B), February (C)

The maximum temperatures at most stations of Ukraine were close (many days with repetitions) to daily absolute temperatures during the winter, especially in December and February. Minimum temperatures were far from the daily absolute minimums. Graphs with minimum and maximum temperatures for selected cities listed below (Figure. 5, 6, 7, 8).

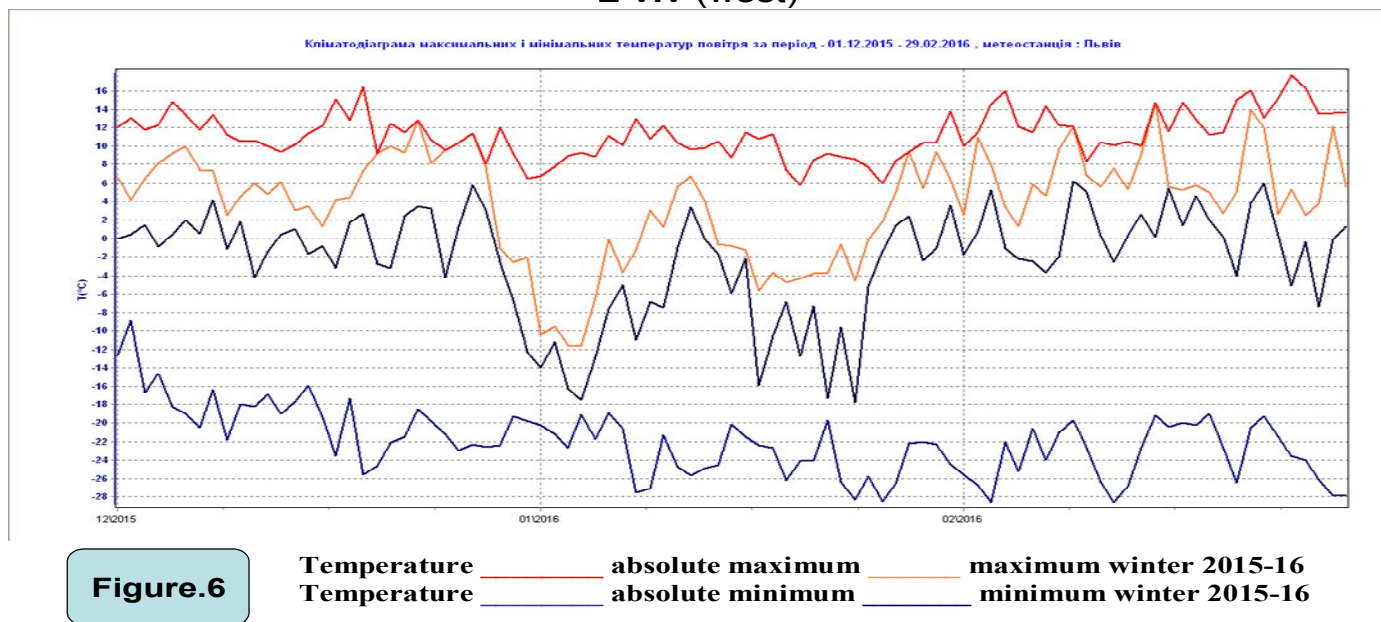
Maximum and minimum temperature winter 2015-16

Kyiv (north)



Maximum and minimum temperature winter 2015-16

L'viv (west)



Maximum and minimum temperature winter 2015-16

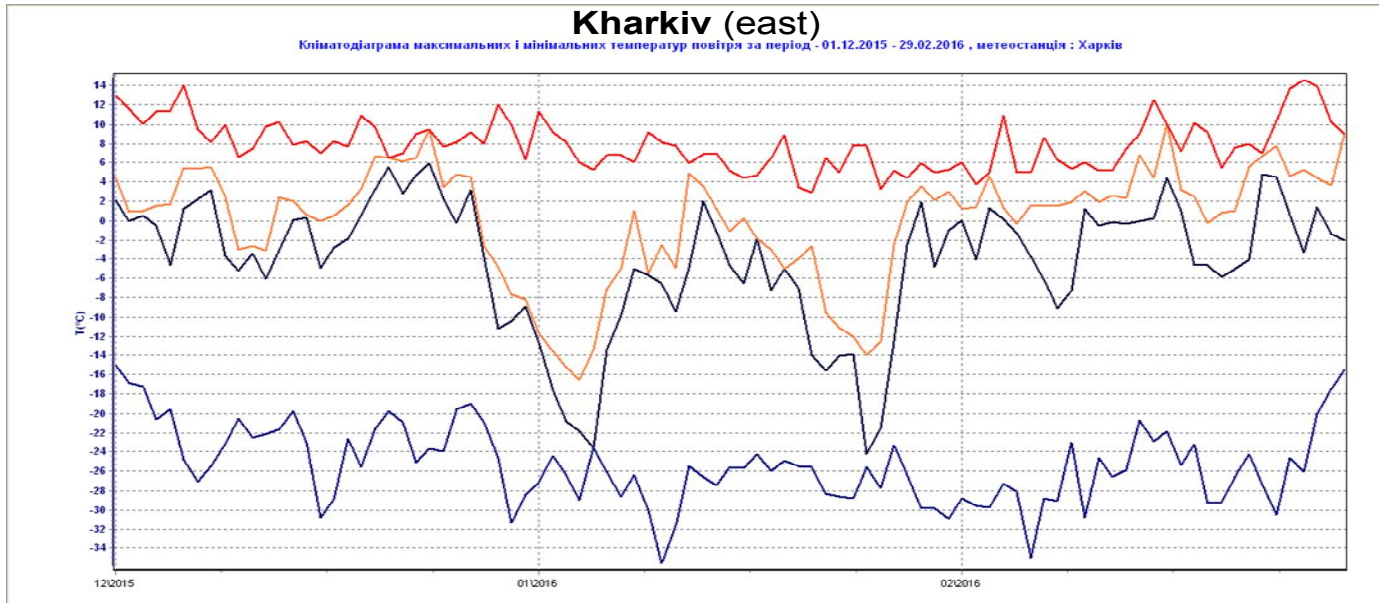


Figure.7

Temperature _____ absolute maximum _____ maximum winter 2015-16
Temperature _____ absolute minimum _____ minimum winter 2015-16

Maximum and minimum temperature winter 2015-16

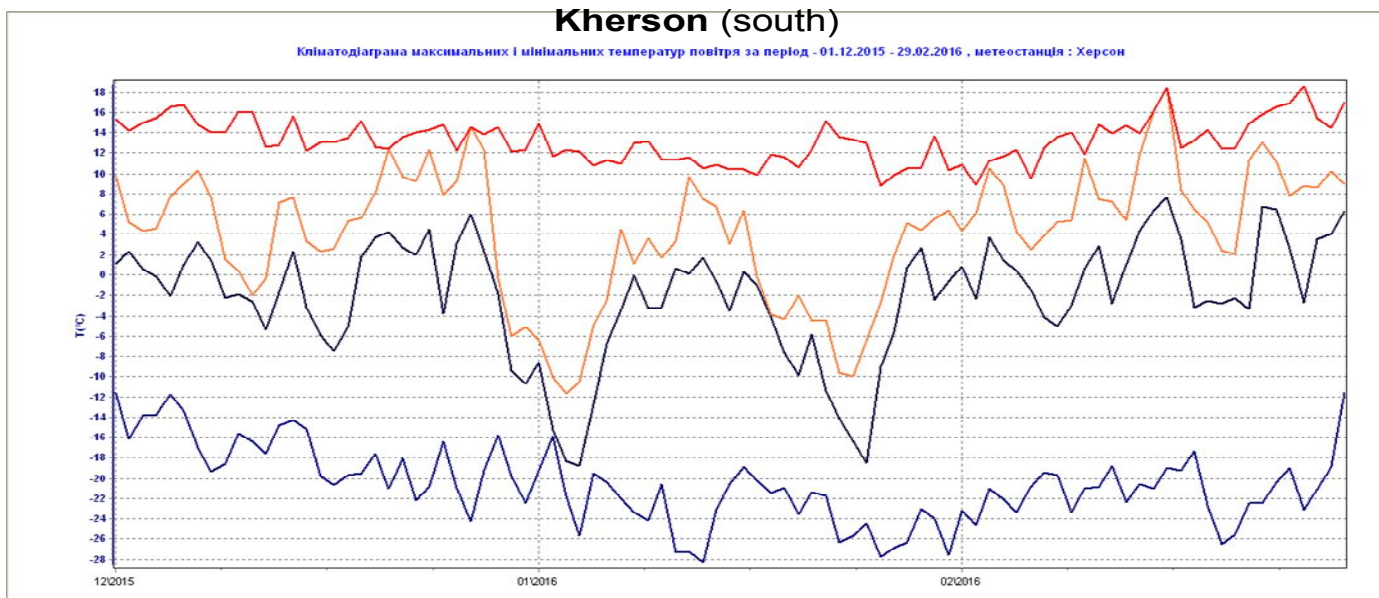


Figure.8

Temperature _____ absolute maximum _____ maximum winter 2015-16
Temperature _____ absolute minimum _____ minimum winter 2015-16