

# Distribution of dry winds in Ukraine under related atmospheric macrocirculation processes



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Hot, dry wind is a widespread high impact phenomenon in Ukraine that may significantly reduce or completely destroy the harvest. Dry winds especially affects to spring grain crops, the active development of which falls on the spring-summer time. Dry winds occur almost every year during the vegetation period and can observe under the long droughty periods as well as a separate phenomenon without a drought. Frequency and evolution of the hot dry winds connects with some synoptic processes, appearance of which depends on macrocirculation processes in the Northern Hemisphere.

**An object of the study** is to define the macrocirculation conditions, which lead to formation of dry winds, and their influence on the frequency of dry winds in Ukraine under the present climate.

## National criteria for dry wind [1]:

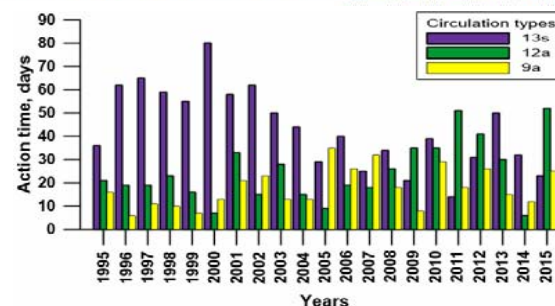
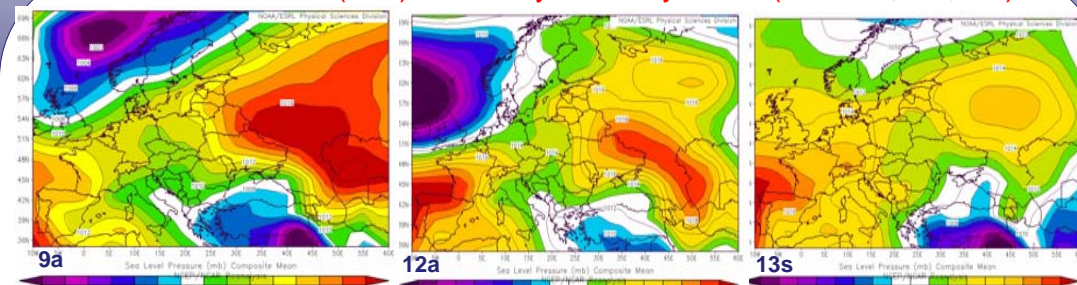
- air temperature 25°C and higher,
- wind speed at 10 m height is 5 m/s and more,
- the relative air humidity is 30% or lower.

The maximum frequency of dry winds observed in August: from 129 days in Steppe (in south) to 21 days in Mixed Forests (in north of country). The least number of the days with dry winds fixes in April (from 4 to 7days).



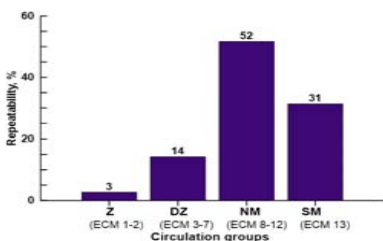
During the dry winds periods maximum of the air temperature can reach up 40°C, as was recorded at the Odessa airport on 23 July, 2007, at the Zaporizhia station on 8 August, 2010 and on 10 August, 2010. The minimum of relative humidity at 4% was observed at the Odessa airport on 20 August, 1998, 15 August, 2001, 24 June, 2002, 15 May, 2003 and 15 August, 2003, and at the Chernihiv station on 8 July, 1997 and 29 May, 2000. Average wind speeds during the dry winds vary from 5.5 to 6.5 m/s and reduce from April to August in all agroclimatic zones.

## Mean SLP fields (hPa) at the days with dry winds (ECM 9a,12a,13s)



Period of 1995-2005 characterized by prevailing of ECM 13a in the days with dry winds.

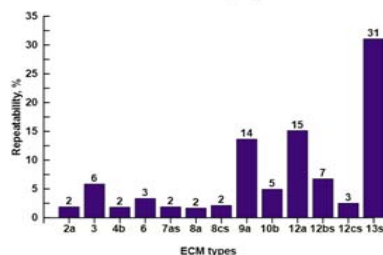
Period of 2007-2015 shown an increasing the number of days with dry winds under increasing of frequency of ECM 12a. The eastern part of Ukraine is influenced by the warm subtropical troposphere flows, where the surface dry winds are develop.



## The repeatability (%) of circulation groups and ECM types at the days with dry winds

Years	Circulation groups			
	Zonal	DZ	NM	SM
1995-2000	0.7	11.6	41.6	46.2
2001-2005	1.2	13.2	46.1	39.5
2006-2010	4.2	16.9	59.0	19.9
2011-2015	3.6	14.7	56.1	25.5

\* (Z) - zonal circulation, (DZ) - zonal disturbance, (NM) - meridional northern circulation, (SM) - meridional southern circulation group [2]



## Conclusions

- The formation of dry wind in Ukraine is associated with the prevailing of meridional type of atmospheric circulation in Northern Hemisphere. The lowest repeatability of days with dry wind is belongs to the zonal circulation group.
- The greatest repeatability of dry wind connects with the ECM (13s and 9a), when the anticyclone is located over Eastern Europe, which is led rapid warming and drying of descending air under a cloudless sky.
- Also favorable conditions corresponds by advection of warm subtropical air mass in the front part of Mediterranean cyclones (ECM 12a), which moving to the Northern Black Sea. During period of 2007-2015 the number of dry wind days increased under the similar increasing in number of days with ECM 12a.

## References

1. *Climate of Ukraine*, (2003), Lipinskiy, V.M., Djachuk, V.A., Babichenko, V.M. eds., Raevskyy Publishing House, Kyiv, 343 p. (in Ukrainian).
2. *Classification of Northern Hemisphere atmospheric circulation by Dzerdzevsky's method* (<http://atmospheric-circulation.ru/about-us>)