

FLUCTUATIONS OF THE GLOBAL ATMOSPHERIC CIRCULATION IN THE XX-XXI CENTURIES

Nina K. Kononova,

Institute of Geography, Russian Academy of Sciences

NinaKononova@yandex.ru

www.atmospheric-circulation.ru

Fluctuations in the global atmospheric circulation in 1899-2014, in the classification by BL Dzerdzhevskii considered. Three circulation epochs identified. Frequency elementary circulation mechanisms (ECM) in each epoch analyzed.

Long-term fluctuations in mean annual air temperature in Northern and Southern hemispheres and the global and also the annual amplitude of air temperature due to changes in the nature of atmospheric circulation are analyzed.

Particular attention is paid to the last period (1998-2014). During this period, in the lower troposphere maximum meridional transport of air masses is observed (on average 335 days per year). In 93 days on average per year macroprocesses with cyclones at the poles, without blocking processes, with three or four cyclones outputs from low to high latitudes in each hemisphere

observed (type 13). On other days macroprocesses with anticyclones at the poles, the outputs of the cyclone from low to high latitudes in two-four quadrants of each hemisphere and the Arctic/Antarctic invasions in their rear, forming a blocking process (types 8 to 12) are marked. As a result, the average annual air temperature in the Northern, Southern Hemispheres and the global ceased to rise each year as in 1981-1997. Although 2014 proved to be the warmest on Earth since 1850.

Due to the growth of the length of the high pressure in winter and summer annual amplitude of air temperature for the present time is growing.

Because of the high pressure over Eurasia winter Atlantic cyclones go to the Arctic, ice in the Kara and Barents Seas decreases. Simultaneous outputs cyclones in different sectors cause the occurrence of natural hazards in different regions.



Fig. 1

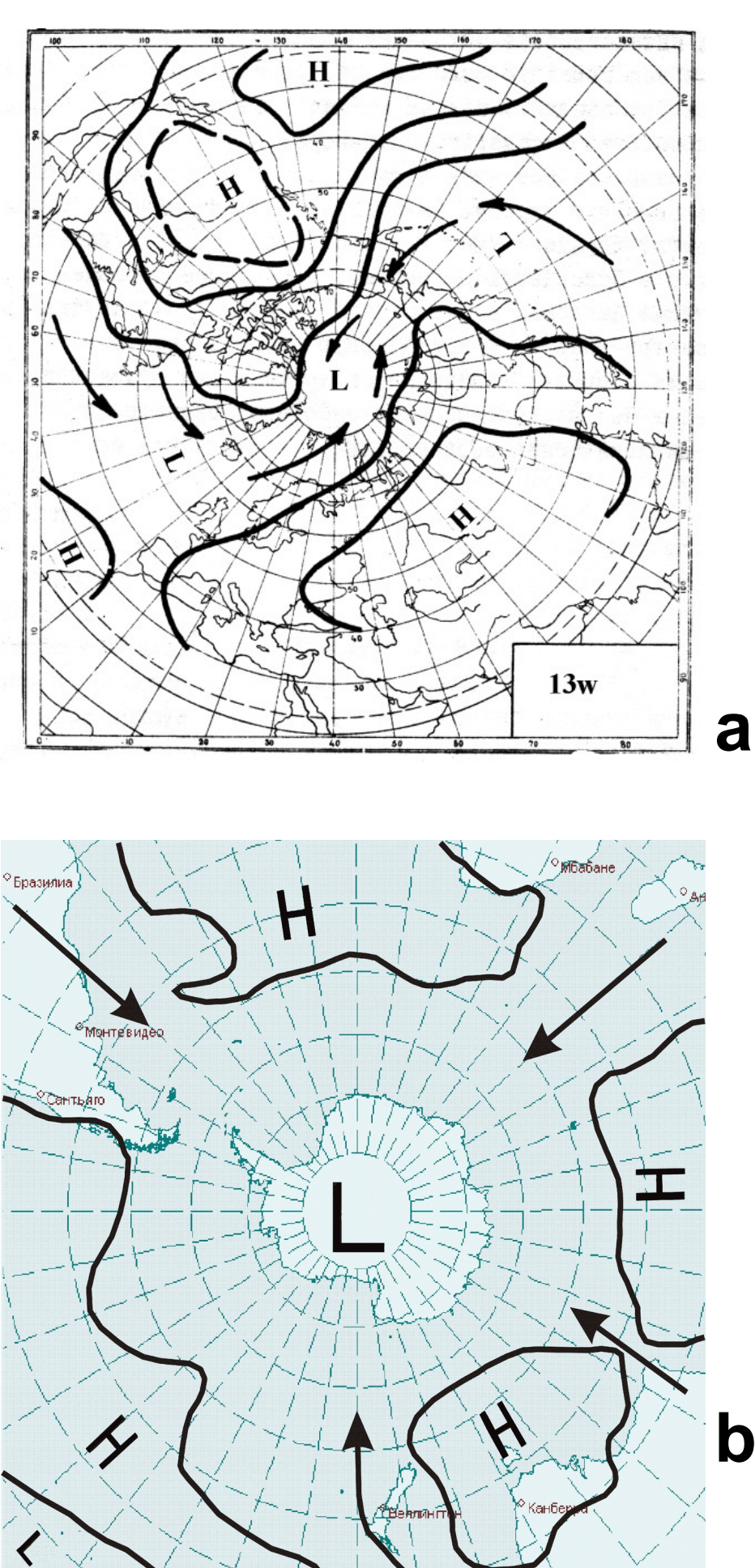


Fig. 2

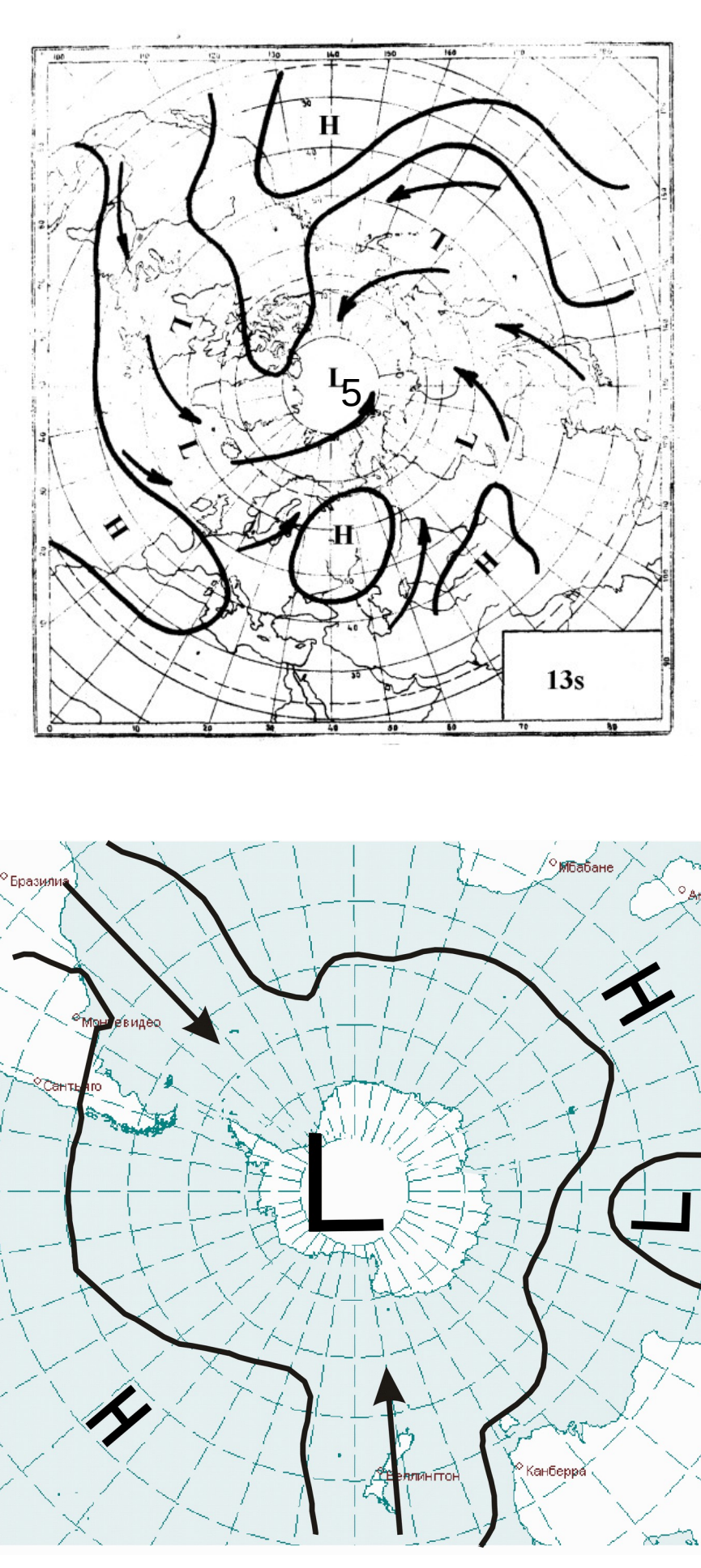


Fig. 3

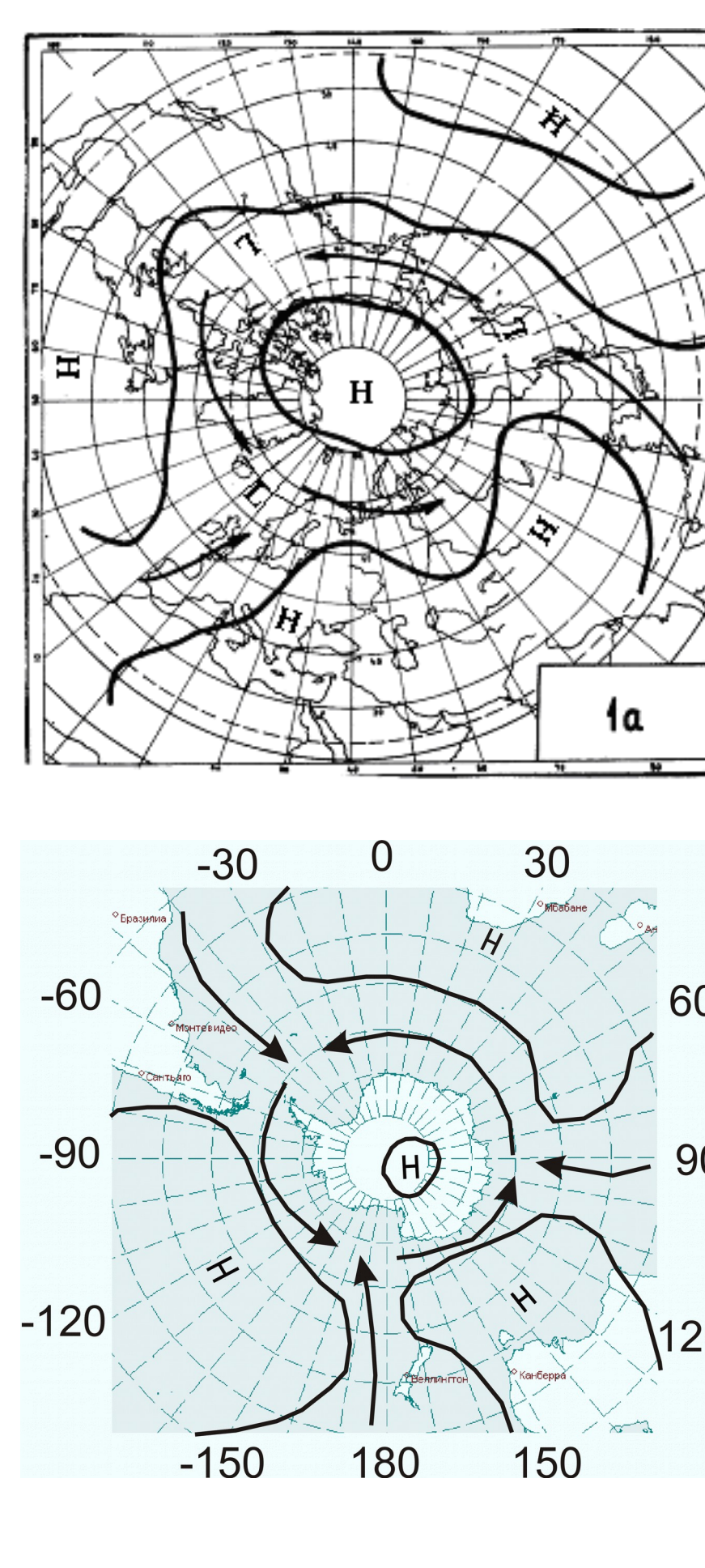


Fig. 4

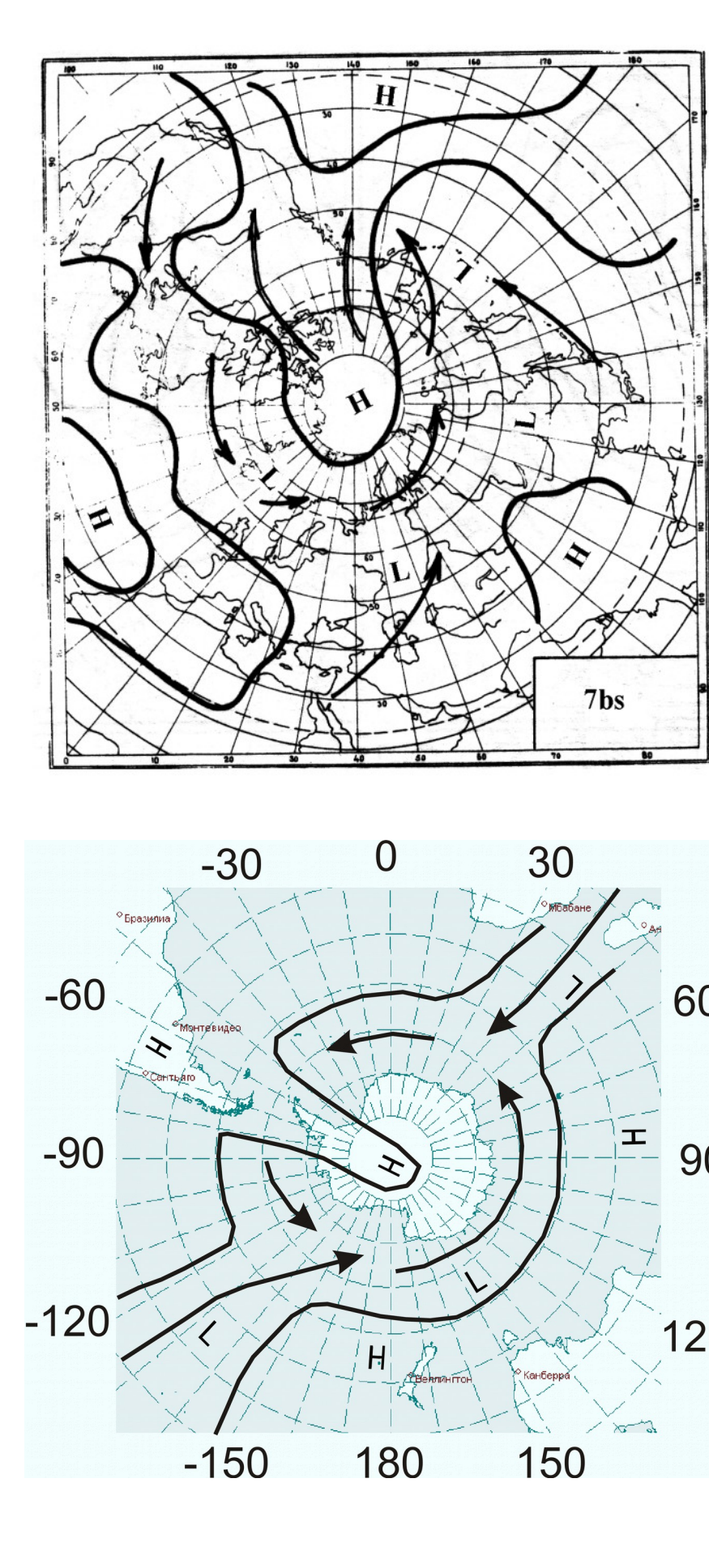


Fig. 5

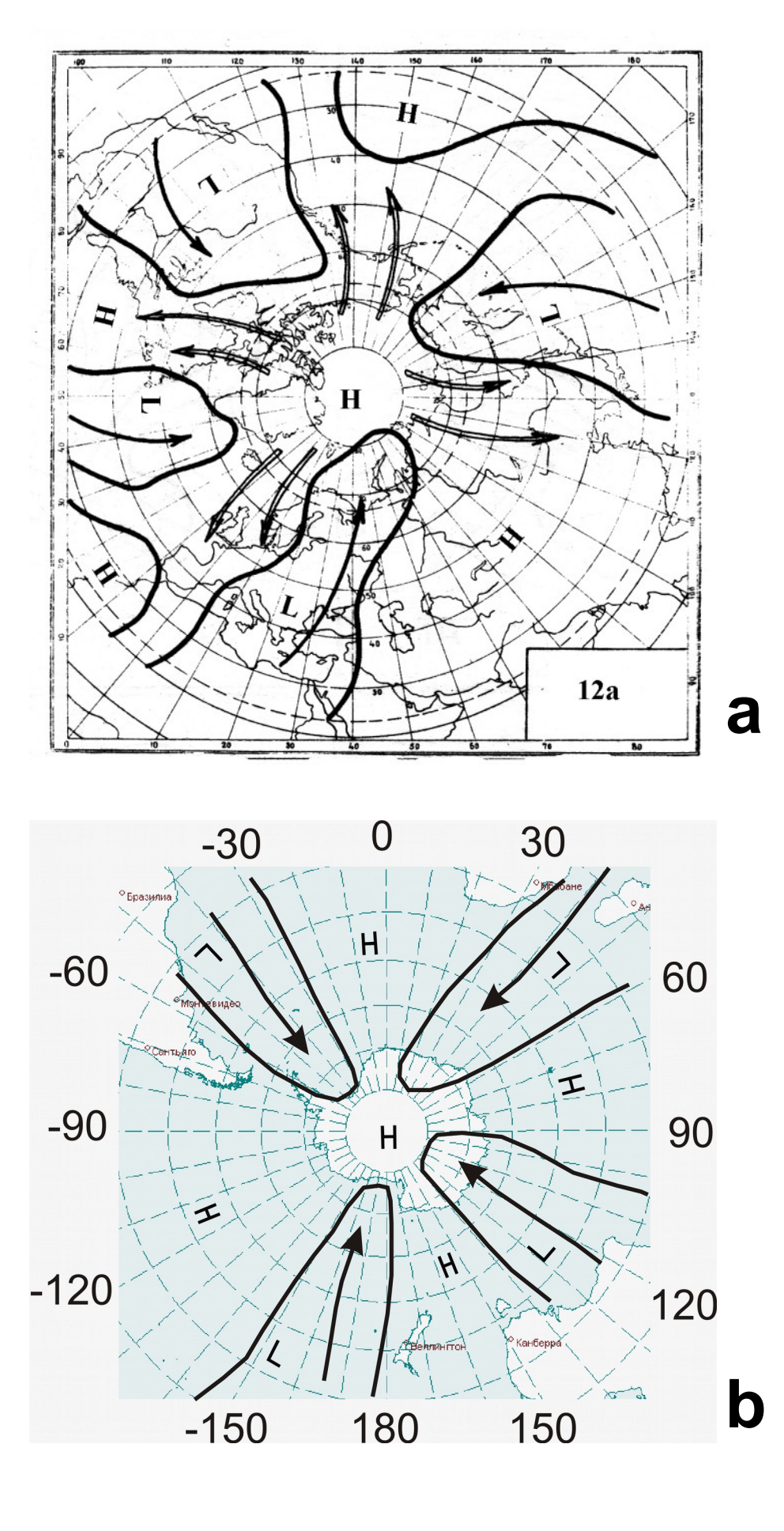


Fig. 6

Fig. 1. Comparison of standard schemes of atmospheric circulation over the Northern and Southern hemispheres (Northern - by BL Dzerdzhevskii, Southern – by PD Astapenko):

a - zonal circulation, b - two meridional blocking processes in each hemisphere, c - three meridional blocking processes in each hemisphere. Dotted arrows - generalized path of cyclones, solid — anticyclones.

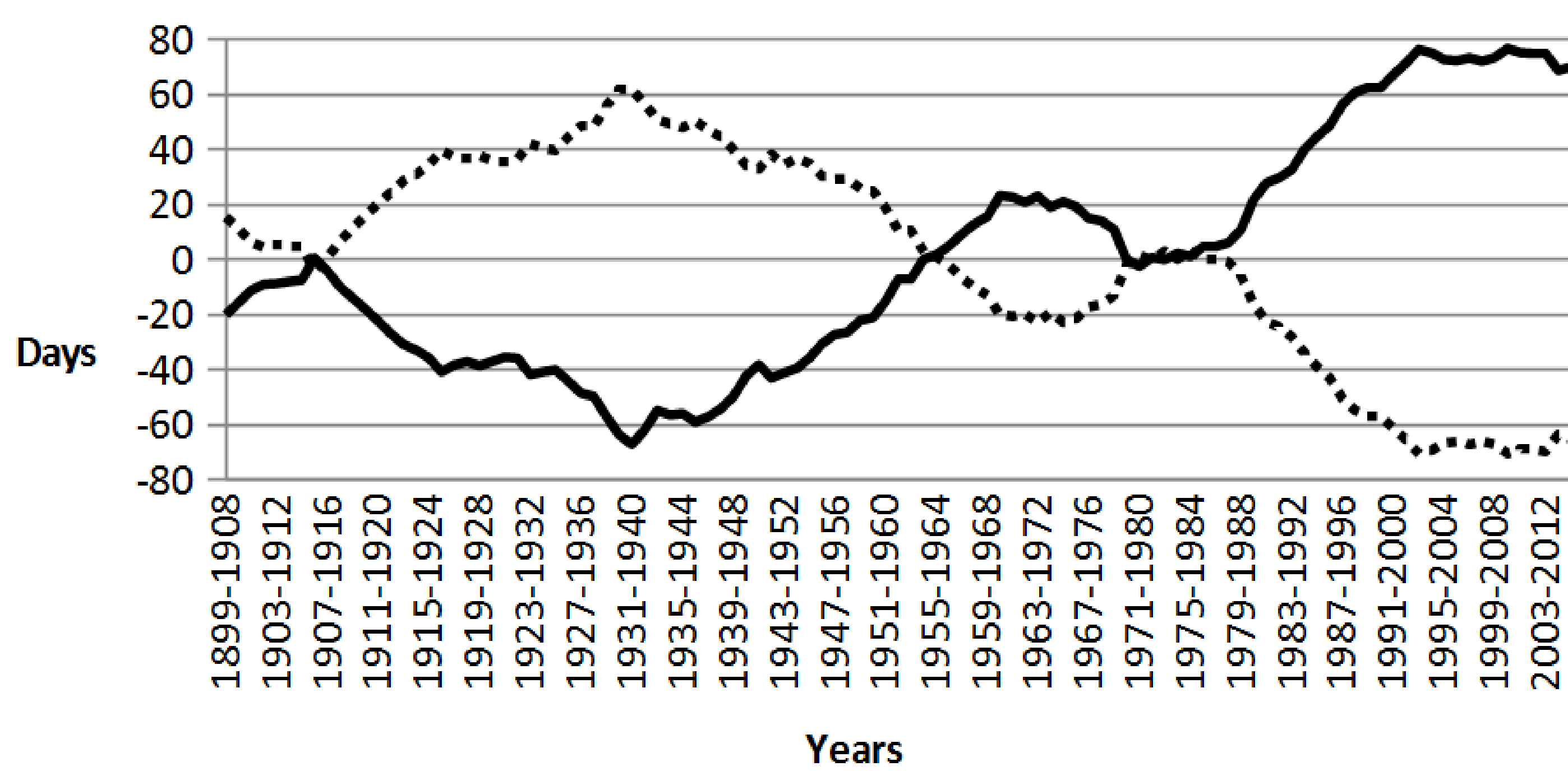
Fig. 2. Dynamic schemes of ECM 13w (for the Northern Hemisphere winter): a - Northern Hemisphere (by BL Dzerdzhevskii), b - the Southern Hemisphere.

Fig. 3. Dynamic schemes of ECM 13s (summer in the Northern Hemisphere): a - Northern Hemisphere (by BL Dzerdzhevskii) b - the Southern Hemisphere.

Fig. 4. Dynamic schemes of ECM 1a (zonal circulation, for the Northern Hemisphere winter): a - Northern Hemisphere (by BL Dzerdzhevskii), b - the Southern Hemisphere.

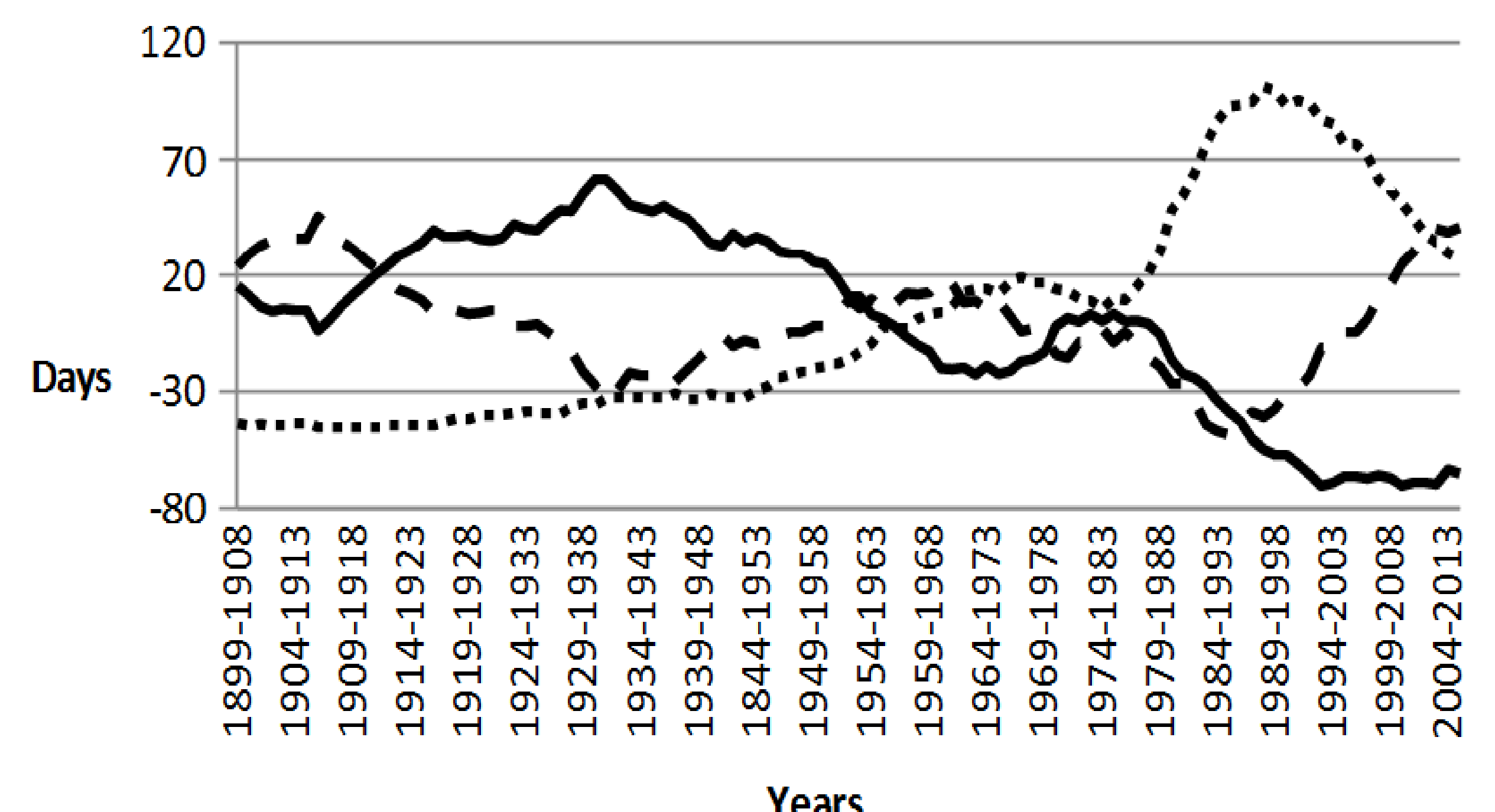
Fig. 5. Dynamic schemes of ECM 7bs (disturbance of zonal circulation, summer in the Northern Hemisphere): a - Northern Hemisphere (by BL Dzerdzhevskii) b - the Southern Hemisphere.

Fig. 6. Dynamic schemes of ECM 12a (group blocking processes, transitional seasons): a - Northern Hemisphere (by BL Dzerdzhevskii), b - the Southern Hemisphere.



..... 1 — 2

Fig. 7. Ten-year moving average of deviations of the total annual duration of the circulation groups for the 1899-2014 from the average for the same years: 1-zonal circulation, 2 - meridional circulation



—— 1 - - - 2 3

Fig. 8. Ten-year moving average of deviations of the total annual duration of the circulation groups for the 1899-2014 from the average for the same years: 1-zonal circulation, 2-blocking processes, 3-way cyclones from low to high latitudes

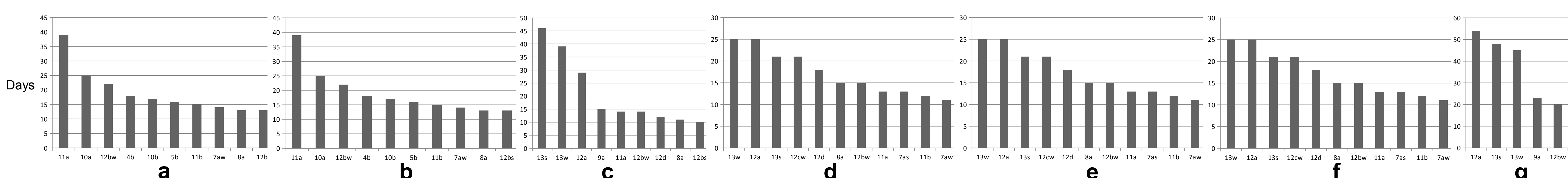


Fig. 9. The longest ECM which average sum results for the specified time period is more than six months: a - first circulation epoch, b - second epoch, c - the third epoch, d - 1957-1969, e - 1970-1980, f - 1981-1997, g - 1998-2014.

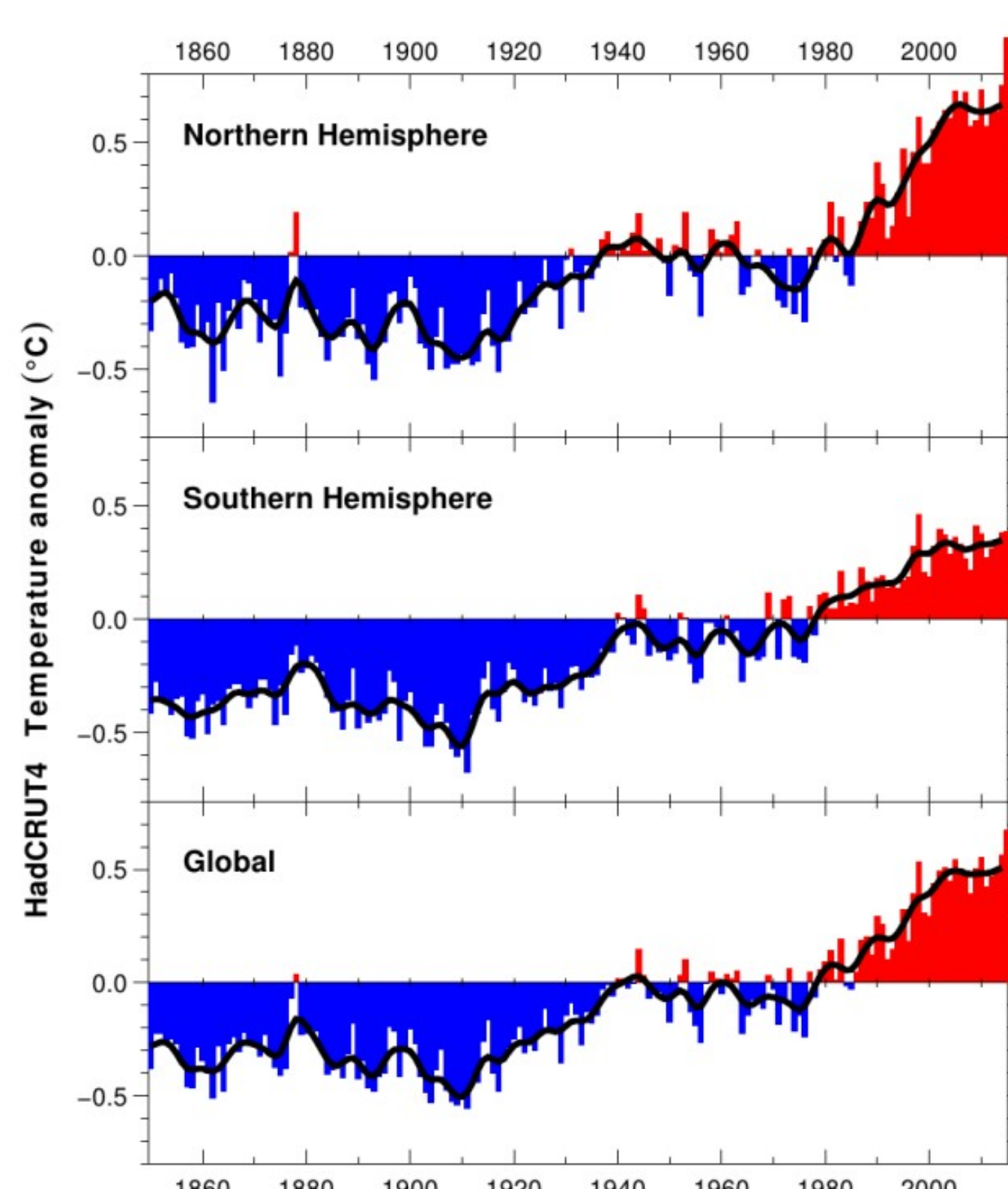


Fig. 10. Deviations mean annual air temperature for the 1850-2014 from the average for the 1961-1990 period by <http://www.cru.uea.ac.uk/cru/data/temperature/> (HadCRUT4): a - the Northern Hemisphere, b - the Southern Hemisphere, c - the Global.

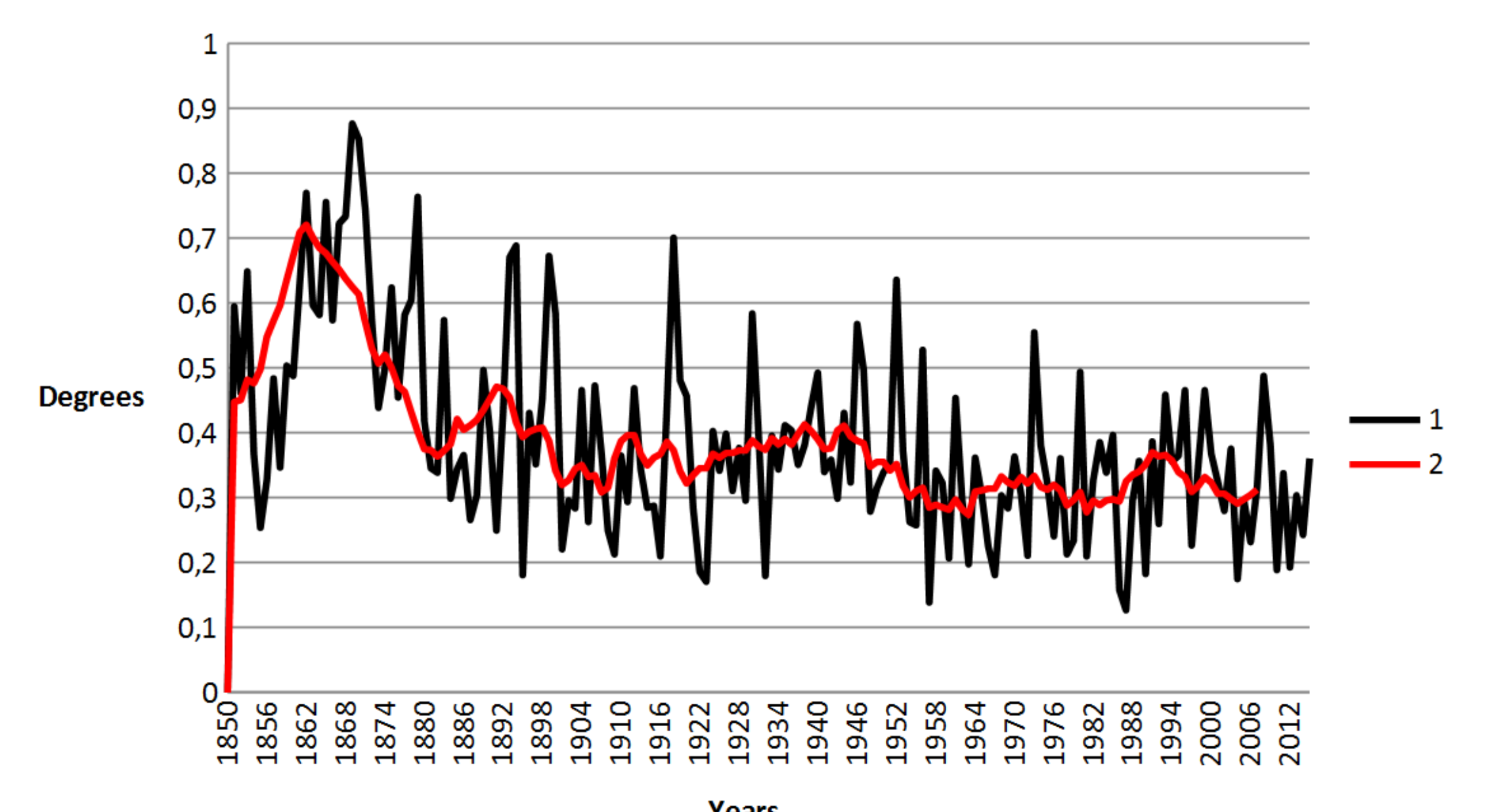


Fig. 11. The annual amplitude of the global surface air temperature for the 1850-2014, count according to <http://www.cru.uea.ac.uk/cru/data/temperature/> (HadCRUT4): 1 - the annual amplitude, 2 - 10-year moving average.