

Heat and cold waves formation in association with atmospheric blockings in the Northern Hemisphere

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To characterize the influence of atmospheric blockings in formation mechanism of heat and cold waves a joint analysis of atmospheric blockings and heat/cold waves was carried out for the Northern Hemisphere basing on ERA-Interim reanalysis data for the period 1979–2019. Heat (for summer season) and cold (for winter season) waves were detected using the criterion proposed in [1], with the necessary condition for its fulfillment for at least 3 consecutive days and for the area at least 6×10^5 km². The criterion proposed in [2] was used as a local blocking condition in this work, with the necessary condition for its fulfillment for at least 5 consecutive days. Blockings and heat (cold) waves were considered to be associated if the distance between centers of blocking and heat/cold wave was less than 15° of longitude and blocking and heat/cold wave took place at the same time.

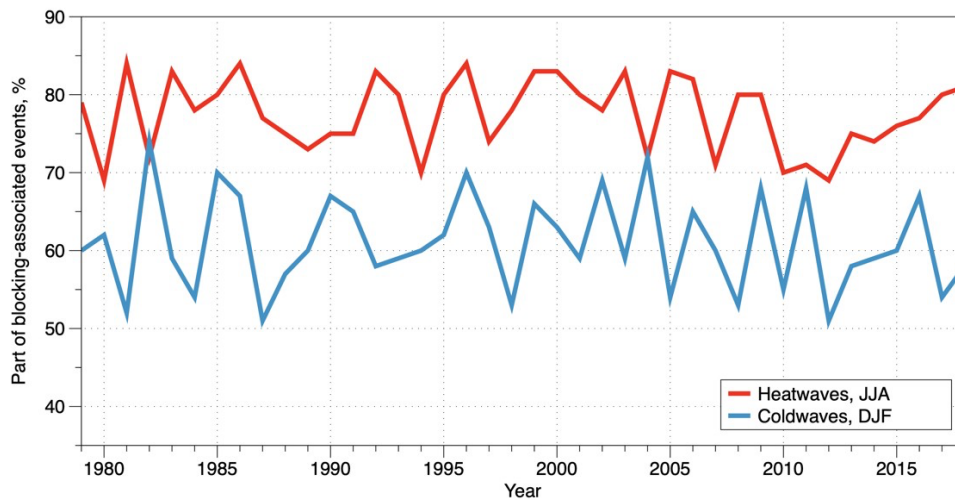


Figure 1. Interannual variations of the fraction (%) of heat and cold waves associated with blocking events.

Figure 1 and Table 1 show the fraction of heat (cold) waves associated with blockings during the 1979–2019 period in the Northern Hemisphere and two sectors: 0°–30°E and 30°–60°E (only in Table 1). The estimates obtained show that on average about 80% of summer heat waves are associated with blockings. In winter on average about 60% of cold waves are associated with blockings.

Table 1. Number of total and blocking-associated heat and cold waves in the Northern Hemisphere and sectors 0°–30°E and 30°–60°E for the period 1979–2019.

Number of events	Heat waves, Summer			Cold waves, Winter		
	NH	0–30E	30–60E	NH	0–30E	30–60E
With blockings	59	15	16	41	11	13
Total	76	20	22	68	17	24
Part of blocking-associated events	78%	75%	72%	60%	65%	54%

Figure 2 shows the intensity of blocking-associated summer heat waves in dependence on blocking duration in the Northern Hemisphere and two sectors (0°–30°E and 30°–60°E) for the period 1979–2019.

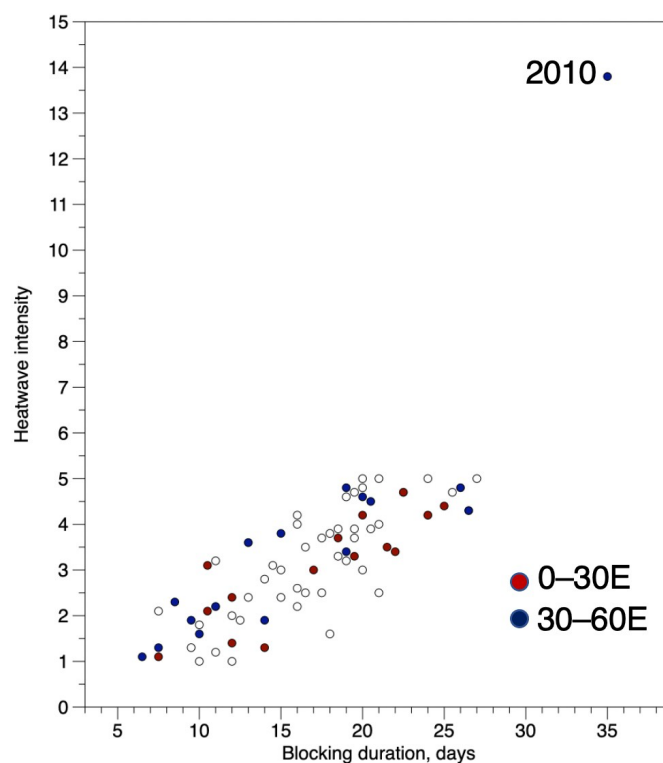


Figure 2. Intensity of blocking-associated summer heat waves in dependence on blocking duration in the Northern Hemisphere and sectors 0°–30°E and 30°–60°E for the period 1979–2019.

According to Fig. 2 the relationship between the duration of blockings and the intensity of the heat wave in the period 1979–2019 did not change significantly, except for the case of a record blocking duration and record heat wave intensity in the summer of 2010 in the European part of Russia.

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References

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- [2] Tibaldi S., Molteni F. (1990) On the operational predictability of blocking. *Tellus* **42A**: 343–365.