Polar mesocyclones and their variability from STARS data

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The annual variations of the frequency of occurrence of polar lows (PL) and their distribution functions depending on the lifetime and characteristic size are characterized according to STARS (Sea Surface Temperature and Altimeter Synergy for Improved Forecasting of Polar Lows) data for the period 2002-2010 [1] (see also [2]). The STARS data are based on satellite infrared images obtained using the AVHRR (Advanced Very-High-Resolution Radiometer) instrument and characterize the parameters of polar mesocyclones over the waters of the Norwegian and Barents Seas with hourly resolution.

Figure 1 characterizes the average number of PL for different months of the year according to STARS data (2002-2010). According to the analyzed data, PL are most often observed in March and January, more than 3 cyclones per month on average. The maximum interannual variability with a standard deviation of more than 2 cyclones is observed in March. In January, the process of PL formation is more stable, with a standard deviation of about 1 cyclone. By the beginning of summer, the probability of PL formation decreases to zero and increases at the beginning of the fall season, reaching its local maximum in November (about 2 cyclones per month). One should note the instability of the manifestation of the local maximum in November, i.e., the interannual variability is large.

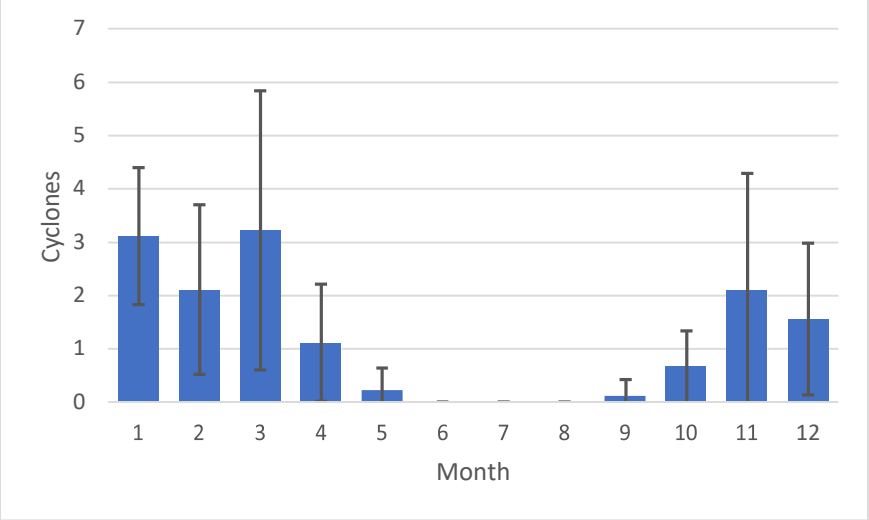

Fig. 1. The average number of PL for different months of the year according to STARS data. Standard deviations are shown by vertical lines.

Figure 2 shows estimates of the probability of PL according to the STARS data, depending on their characteristic size. According to Fig. 2, the PLs with a characteristic size of about 200 km are the most likely.

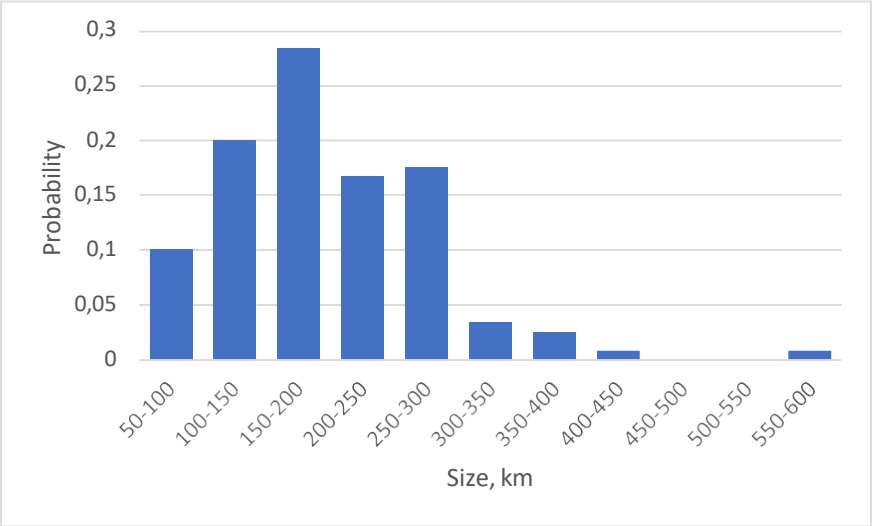

Fig. 2. The estimates of the PL probability depending on their characteristic size R (according to STARS data).

Figure 3 presents estimates of the probability of PLs according to STARS data depending on their characteristic size. According to Fig. 3, short-lived PLs with a lifetime of no more than 12 hours are the most likely.

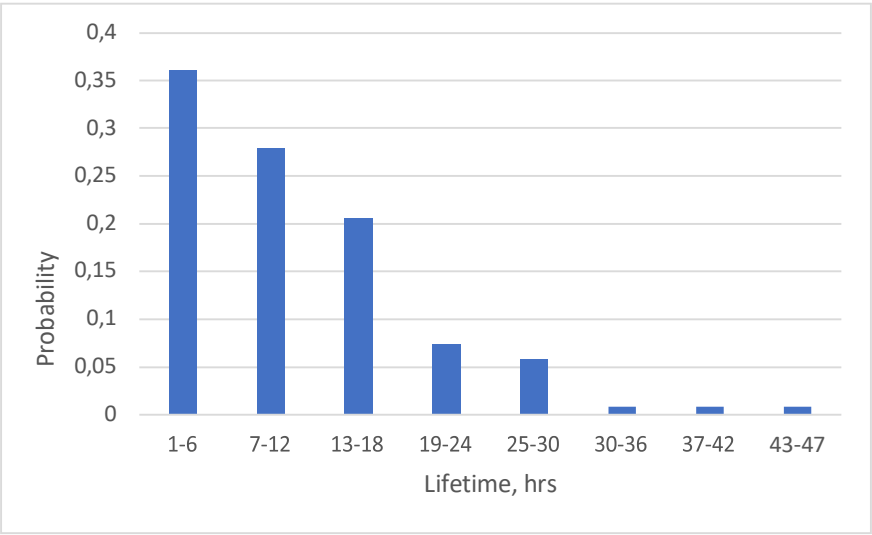

Fig. 3. Estimates of the PL probability depending on their lifetime (according to STARS data).

The features of the lifetime and characteristic dimensions of PLs for different months of the year are manifested. In particular, the biggest values of the average duration were noted for March and January - about 1.5-2 days. For the other months, the average PL duration is less than a day (including November, when the local maximum of the average lifetime appears).

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References

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[2] Akperov M.G., Mokhov I.I., Dembitskaya M.A. (2017) Arctic mesocyclones from satellite data and model simulations. Current Problems in Remote Sensing of the Earth from Space. **14** (3): 207-304. DOI:10.21046/2070-7401-2017-14-3-297-304