Trends in Low Cloud Boundary for Antarctic Region

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It have been detected for Globe for the period 1964-1998 years that low boundary (ceiling) means for cloud layers (CL) with cloud amount 0-100% of the sky (CA_0-100) in atmospheric layer 0-10 km are decreasing for central month of the season (January, April, July, October) separately and in total with decadal changes means in m decade^{-1}: -35; -49; -51; -41 and -43 correspondently [Chernykh et al, 2001]. The significance of the trends is not less than 95%. The mean values and trends of low boundary (LB) for CL with CA_0-100 are presented in this paper for Antarctic region for different atmospheric layers in detail: for different months, seasons and for year. In reality, LB for CL with CA_0-100 specifies the beginning of temperature-humidity layering of atmosphere. It should be noted, that LB value, detected by different method, can be some different due different accuracy of determination method [Chernykh and Alduchov 2004; Naud et al, 2003].

The investigation was made on base of dataset contained time series of cloud boundaries and cloud amount for cloud layers, created on the base of radiosonde sounding data CARDS [Eskridge et al, 1995] and CE-method for cloud amount and boundaries reconstruction [Chernykh and Eskridge, 1996; Chernykh and Alduchov 2004] for Antarctic stations. Seven coastal stations (Bellingshausen (1970-1999), Halley (1966-2001), Novolazarevskaya (1969-2001), Mawson (1969-2001), Davis (1970-2001), Mirny (1969-2001), Casey (1969-2001)) were selected for research.

Linear trends in LB of CL with CA_0-100 were calculated by the method based on the using of time series with taking into account the possible time correlations of observations [Alduchov et al, 2006].

Multiannual averages of LB and decadal changes for year of LB of CL with CA_0-100 in different atmospheric layers are presented in Table1.

Table 1. Multiannual averages (m) of LB (in meters) and decadal changes (Δ) of LB (in meters decade^{-1}) of CL with CA_0-100 in different atmospheric layers. The significance of the trends is not less than 50%. Trend value with significance not less than 95% marked *.

Station	Atmospheric layer							
	0-2 km		2-6 km		6-10 km		0-10 km	
	m	Δ	m	Δ	m	Δ	m	Δ
Bellingshausen	488	-35*	2794	-	6850	-	723	-66*
Halley	590	18	2811	-76*	6786	-44*	1029	-184*
Novolazarevskaya	701	12	2560	-23*	6812	-60*	852	-41*
Mawson	606	-35*	2551	-79*	6698	-181*	652	-28
Davis	527	-24*	2612	-126*	6717	-196*	590	-
Mirny	625	54*	2766	-48*	6855	-70*	864	-30
Casey	496	20*	2590	-106*	6668	-173*	576	-61*

Mean values for LB of CL with CA_0-100 in atmospheric layers 0-2 km, 2-6 km, 6-10 km, 0-6 km, 2-10 km, 0-10 km over surface level are presented at fig.1a for different months, seasons and for year. Figure 1a shows specific properties (mean values and its annual variations) of LB of CL with CA_0-100 in different atmospheric layers for the stations. Figure 1b demonstrates that climatic changes of the LB of temperature-humidity layering in atmosphere over Antarctica are inhomogeneous in the time and space. The significance of the trends is not less than 50%.

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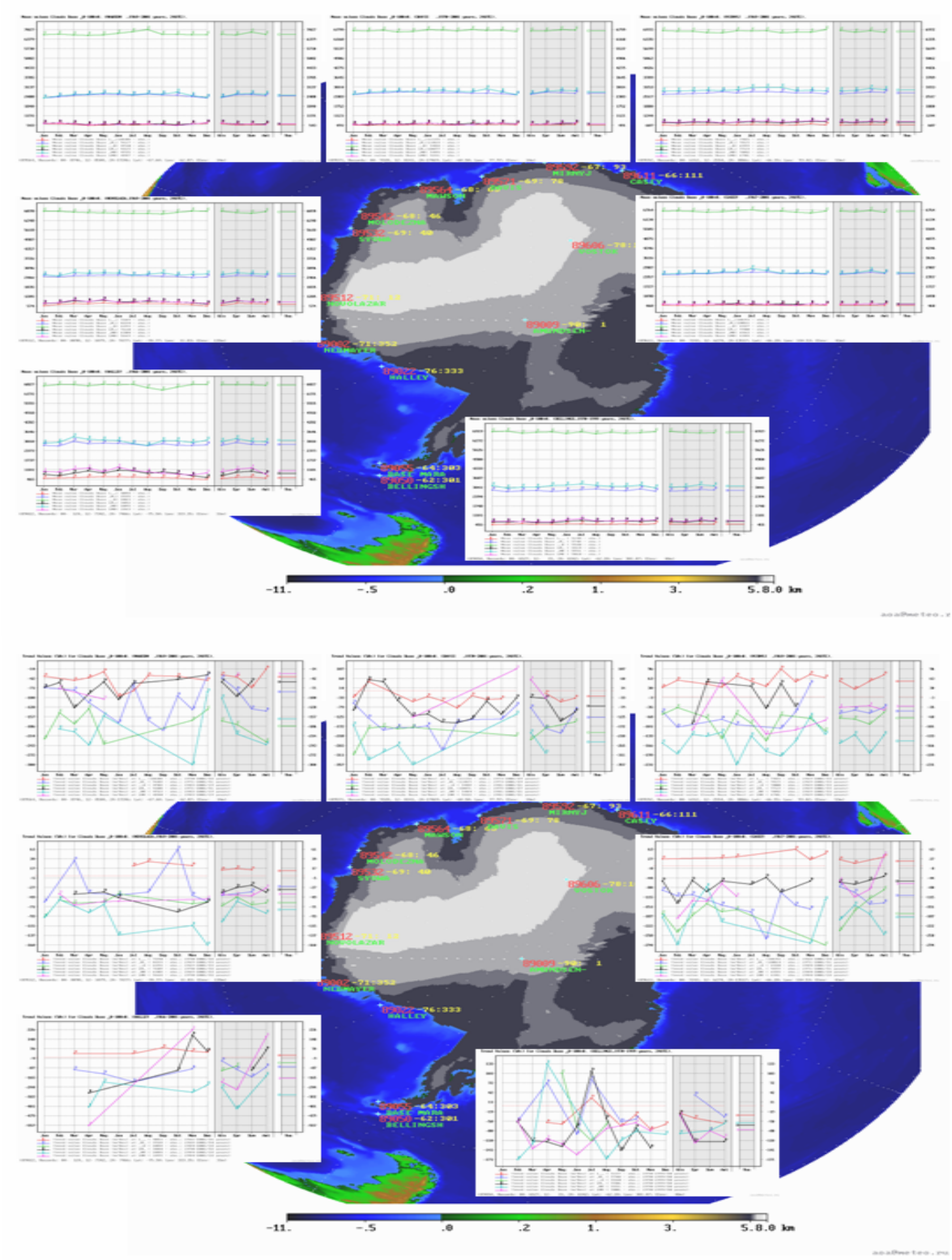

Figure 1. (a) Mean values for low boundary of cloud layers with cloud amount 0-100% for different months (at the left), seasons (in the center; winter – December, January, February) and for year (at the right) in different atmospheric layers: 0-2 km - (A, red lines), 2-6 km - (B, navy lines), 6-10 km - (C, green lines), 0-6 km – (D, black lines), 2-10 km – (E, blue lines), 0-10 km – (I, pink lines). (b) Corresponding trends. The significance of the trends is not less than 50%. Antarctic stations (from bottom to clockwise): Bellingshausen, Halley, Novolazarevskaya, Mawson, Davis, Mirny, Casey.