Trends in Low Boundary of Cloud Layers with Cloud Amount 80-100% of the Sky for Antarctic Region

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It have been shown for Globe for the period 1964-1998 years that low boundary (ceiling) means for cloud layers (CL) with cloud amount 80-100% of the sky (CA80) 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 of -27 m/decade, -27 m/decade, -19 m/decade, -25 m/decade and -24 m/decade correspondently [Chernykh and Alduchov, 2000; Chernykh et al, 2001]. The significance of the trends is not less than 95%. The estimations of low boundary (LB) means for CL with CA80 and trends in LB are presented in this paper for Antarctic region more particularly: for different months, seasons and for year for different atmospheric layers.

Dataset contained time series of cloud boundaries and cloud amount for CL, created on base radiosonde sounding data CARDS and CE-method for cloud amount and boundaries reconstruction [Chernykh and Eskridge, 1996; Chernykh and Alduchov 2004] for Antarctic region were used for the investigation. Seven coastal Antarctic stations: Bellingshausen (1970-1999 years), Halley (1966-2001 years), Novolazarevskaya (1969-2001 years), Mawson (1969-2001 years), Davis (1970-2001 years), Mirny (1969-2001 years), Casey (1969-2001 years) were selected for research.

Linear trends were calculated by the method based on the using of observations with taking into account the possible time correlations of observations [Alduchov et al, 2006].

Mean values and trends for LB of CL with CA80 for the 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 figure 1. The significance of the trends is not less than 50%.

For example (figure 1a) multiannual averages for LB of CL with CA80 in the atmospheric layer 0-2 km are 0.5 km for Bellingshausen, 0.6 km - for Halley, 1.2 km – for Novolazarevskaya, 1.2 km - for Mawson, 0.9 km - for Davis, 0.9 km – for Mirny and 0.7 km for Casey. In atmospheric layer 0-10 km they are about 1.8 km for Bellingshausen, 2 km - for Halley, 4.1 km – for Novolazarevskaya, 2.5 km - for Mawson, 2 km - for Davis, 3.4 km – for Mirny and 1.7 km for Casey.

Figure 1b demonstrates that climatic changes of LB for overcast condition of the sky in Antarctic atmosphere are inhomogeneous in the time and space.

Decreasing of LB in atmospheric layer 0-10 km for year was detected for stations: Bellingshausen, Novolazarevskaya, Mawson and Davis with decadal changes in km decade^{-1}: 0.2; 0.3; 0.1 and 0.3.

Small decreasing of LB in atmospheric layer 0-2 km for year was detected for stations: Bellingshausen, Mawson and Davis with decadal changes in m decade^{-1} 30; 13; 13 correspondently.

Small increasing of the LB in atmospheric layer 0-2 km for year was detected for stations: Halley and Mirny with decadal changes in m decade^{-1}: 20 and 60 correspondently.

Increasing of cloud amount over the stations can lead to decreasing of LB of CL with CA80 and vice versa decreasing of cloud amount over the stations can lead to increasing of LB of CL with CA80. Changes in the frequencies of different cloud types can lead to detected LB changes too.

The results can be used for comparison with results obtained on base surface and satellites observations, in aviation needs.

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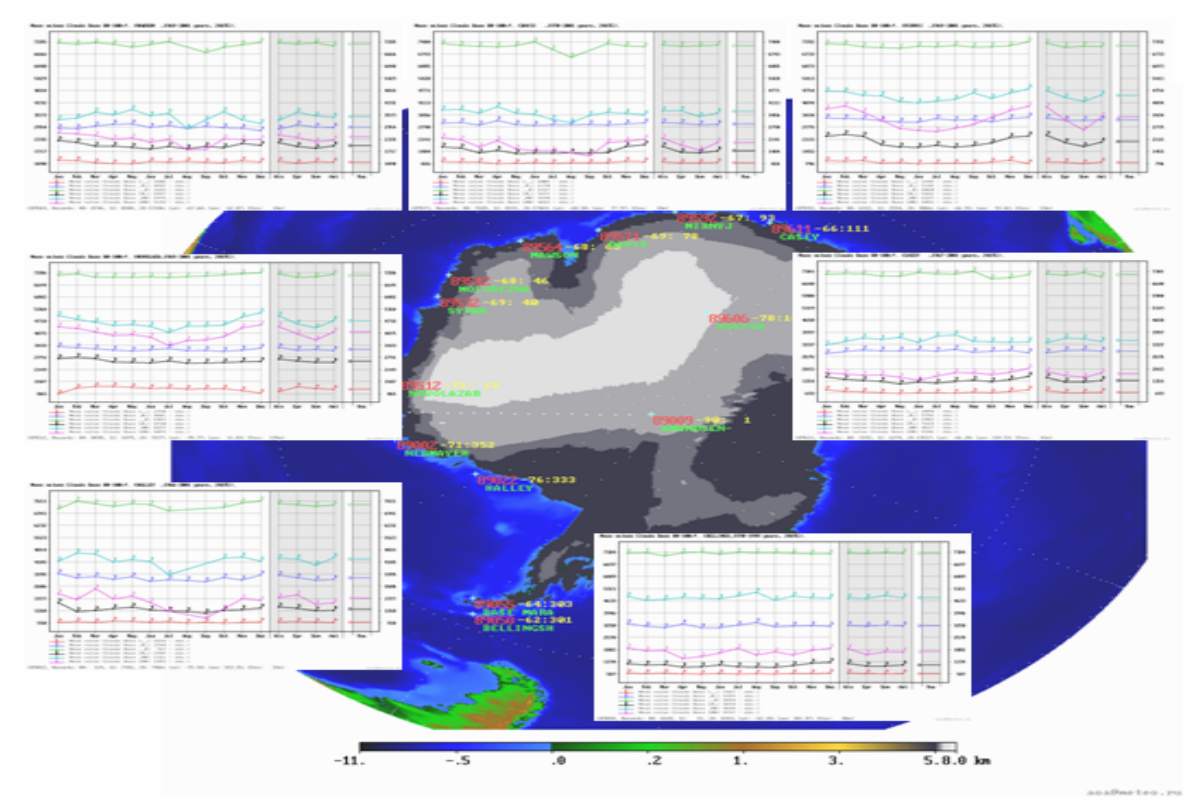

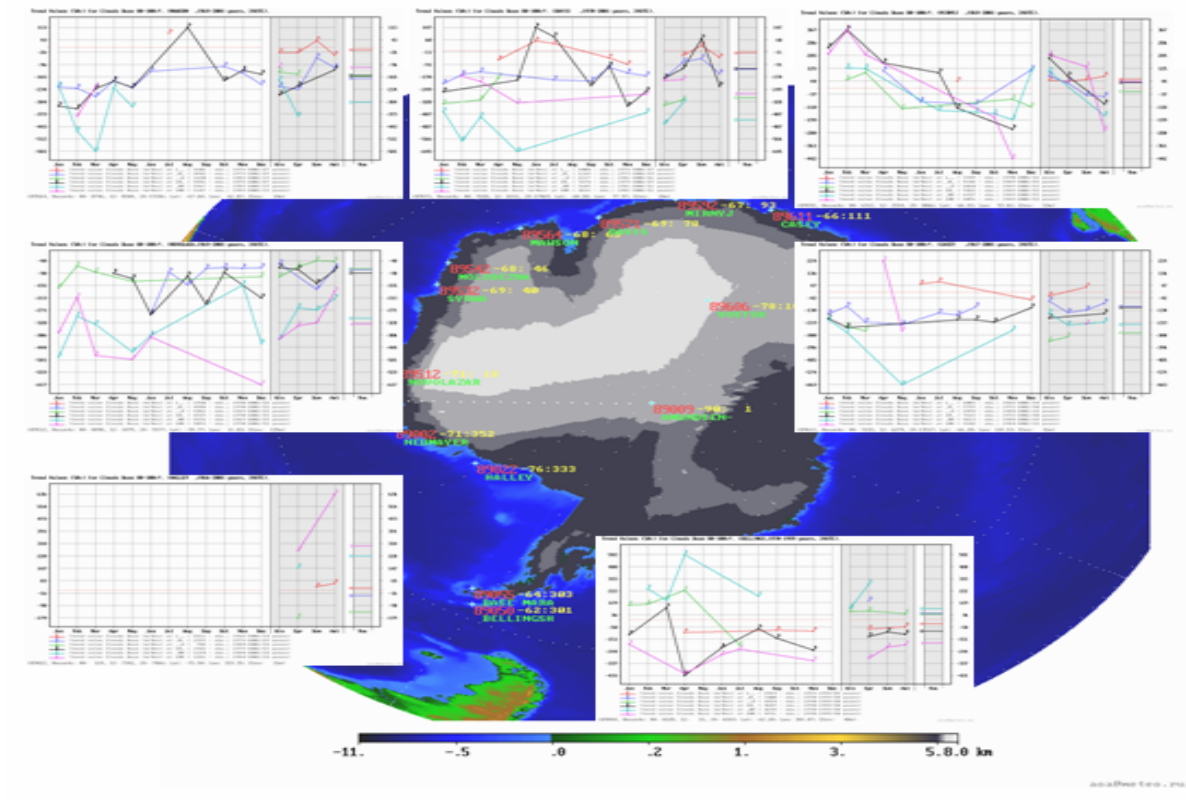

Figure 1. (a) Mean values for low boundary of cloud layers with cloud amount 80-100% of the sky for different months (at the left), seasons (in the center; winter – December, January, February) and for year (at the right) in different atmospheric layers: 0-2 km - (A, red lines), 2-6 km - (B, navy lines), 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.