About Cloudiness Low Boundary over Antarctic Peninsula

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Last time the researches of cloudiness vertical macrostructure and its climatic changes on base sonde observations are conducted in Russia, USA, Great Britain very active [Chernykh et al. 2001, 2003a, Naud, 2003, Wang, 1999]. This can be explained by clouds effect on solar radiation. Antarctic peninsula is a region with good known warming [Comiso, 2000; Marshall et al. 2002]. It is known that low boundary (LB) is one of main characteristics of cloudiness. In this paper mean values of LB for atmospheric layers 0-2 km, 2-6 km, 6-10 km, 0-10 km for different cloud amount 0-20%. 0-60%, 0-80%, 0-100% of the sky are presented for all seasons and for year. Also climatic changes of LB are discussed. Researches was made for Russian station Bellinsgshausen, placed near Antarctic peninsula, because warming for this station was detected by surface, sonde and satellite observations [Comiso J.C., 2000; Chernykh and Alduchov, 2003b, 2003c].

Researches are made on base Aerological dataset CARDS (Eskridge et al. 1995) for period 1970-1999 years. CE-method was used to determine cloud boundaries and amount from temperature and humidity profiles [Chernykh and Eskridge 1996, Chernykh et al, 2001]. Trends in anomalies for all parameters were calculated by linear regression with using measured values with provision for correlation dependence in time.

Multiyear mean values of LB for cloud layers with cloud amount 0-100% in atmospheric layers 0-2 km, 2-6 km, 6-10 km equal to 488 m, 2794 m and 6850 m accordingly (Table 1). The values vary with season and gradation of cloud amount (0-20%. 0-60%, 0-80% 0-100% of the sky). For some comparison with previous results note, that stratus is most frequently occurring cloud type at region around Bellinsgshausen for all seasons [Warren et al., 1986]. An example, for winter[1] average base height is 46 decameters for stratus, stratocumulus and fog [Warren et al., 1986]. As it follows from Table 1, for winter mean value of low boundary detected from sonde measurements equal 472 m. It is easy to see, that for winter difference between averaged low boundaries determined from surface observations and detected by CE -method from temperature and humidity profiles for low clouds is near 12 meters. So, agreement enough good. As it was shown before, value of the mistake in determination of cloud boundaries from sonde measurement depends from time constants of humidity and temperature sensors [Chernykh et al, 2001]. But in fact, it depends from time constant of humidity sensors largely, because time constant for temperature sensors is well below than for humidity sensors. According information from AARI, over all period of sonde observations at station Bellinsgshausen (1970-1999 years) relative humidity was measured by goldbeater’s skin hygrometer with time constant of near 0.7 min troposphere.

TABLE 1. Averaged values of low boundary for cloud layers detected by CE-method in atmospheric layers 0-2 km, 2-6 km, 6-10 km and 0-10 km for cloud amount 0-20%, 0-60%, 0-80%, 0-100% of the sky. Seasons: I - December - February; II – March- May; III – June- August; IV – September-November.

Cloud amount	Atmospheric layer 0-2 km					Atmospheric layer 2-6 km				
	Season				Year	Season				Year
	1	2	3	4		1	2	3	4	
0-20%	653	664	883	819	755	3015	2974	2918	3011	2987
0-60%	569	598	688	668	626	2889	2908	2890	2990	2927
0-80%	550	563	688	625	598	2859	2835	2910	2928	2887
0-100%	472	481	504	496	488	2785	2741	2843	2805	2794

Cloud amount	Atmospheric layer 6-10 km					Atmospheric layer 0-10 km				
	Season				Year	Season				Year
	1	2	3	4		1	2	3	4	
0-20%	6813	6791	6628	6704	6771	1708	1245	1600	2452	1747
0-60%	6713	6791	6778	6717	6752	955	924	1353	1177	1145
0-80%	6770	6853	6782	6738	6780	867	837	1379	987	1013
0-100%	6894	6854	6812	6818	6850	732	661	755	726	723

[1] For other seasons base heights for stratus for region around Bellinsgshausen are absent in Warren et al., 1986

In atmospheric layer 0-10 km multiyear mean value of LB for cloud layers with amount 0-100 % equal to 723 m (Table 1). Together with cloud amount increasing from 0-20% to 0-80% LB mean decrease from 1747 m to 1013 m.

It was founded that low boundaries for clouds with amount 0-100% of the sky in atmospheric layers 0-2 km and 0-10 km for Bellinsgshausen decrease with decadal changes of –35* m/decade and –66* m/decade accordingly[2].

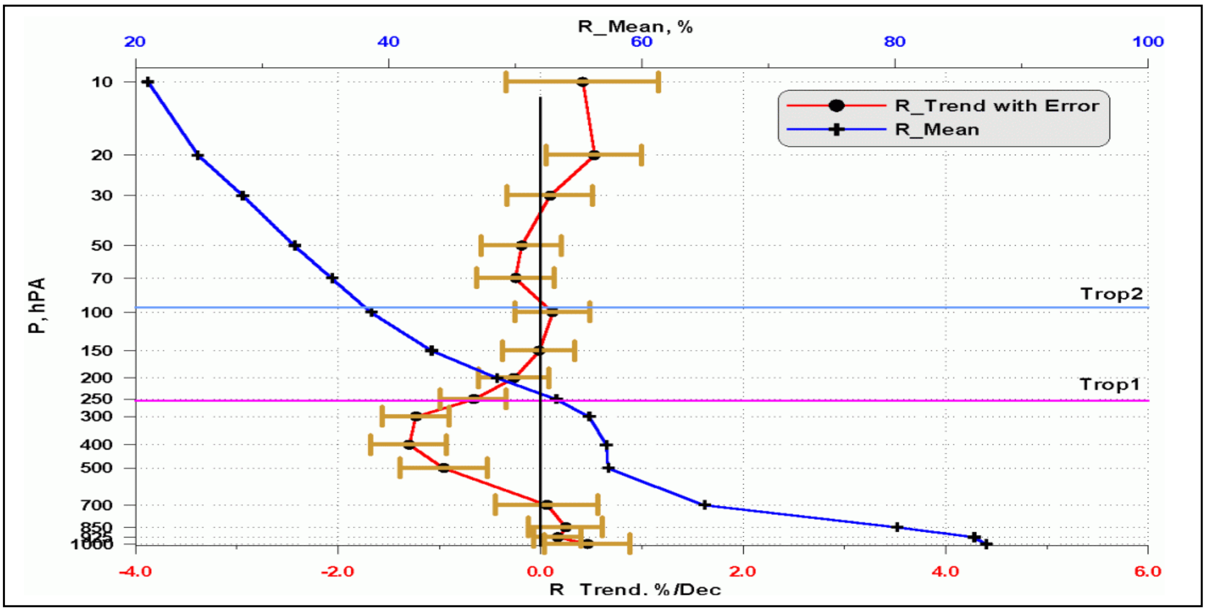

Figure 1. Mean and trends in anomalies of relative humidity R for standard isobaric levels for Bellingshausen. 1970-1999 years. CARDS. Trends in anomalies were calculated by linear regression with using measured values with provision for correlation dependence in time.

This can be partially explained by small increasing of relative humidity in low troposphere, as indicate fig.1. Moreover increasing in frequency of low clouds with decadal changes of 2.1 %decade^{-1} was founded in spring. Note, that largest trend for surface temperature anomalies (0.65 °C decade^{-1}) was detected just for spring *too* (Chernykh and Alduchov, 2003c).

This study is useful to gain insight into climate and climate change in Antarctica. Further researches should be useful. The research was partly supported by RBRF, project 01-05-65285.

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[2] All trends were detected with significance level not less than 95%.