# Changes of the zonal atmospheric circulation at the Last Glacial Maximum as it is simulated by atmospheric global circulation models in PMIP

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Complexity of the atmospheric circulation raises a problem of looking for simple clear indices combining circulation features into short and expressive picture. For evaluation of the global zonal winds regime in work [Petrossyants, Gushchina, 1998] new index of zonal wind speed component was successfully applied. It is calculated by integration of zonal wind speed along the latitude. The positive values of an index testify to prevalence of western circulation, negative – of eastern circulation.

Previous works demonstrated, that the index adequately reflects features of modern atmospheric circulation. That fact has allowed us to apply it to research climate modeling results simulated by atmospheric general circulation models (AGCMs) and to evaluate circulation changes at Last Glacial Maximum (LGM: ca 21,000 calendar yr B.P., equivalent to ca 18,000 $^{14}$C yr B.P.) simulated by these models. Monthly mean values of simulated zonal wind speed for present-day (17 AGCMs) and LGM (8 AGCMs) climate scenarios were taken from PMIP (Paleoclimate Modelling Intercomparison Project) database. Analysis was carried out for simulations with fixed sea surface temperature. Global atmospheric circulation for current climate (control run) and 21 ka is studied at 850 and 200 hPa isobaric surfaces.

Before to use the index for palaeoscenario it was applied for simulated zonal wind component of present day climate (fig.1). Results had been compared with index values calculated on the base of NCEP/NCAR Reanalysis 1948-1997 [Sourkova, Gushchina, 2002]. Comparison showed satisfactory agreement and allowed to proceed to calculations for LGM.

Before to compare circulation for LGM and control run, we calculated mean index values within all incorporated AGCMs for the control run and LGM run, and then for each time snapshot we determined standard deviation from that mean values. Thus we could analyze intermodel variability. Use of t-criteria of Student distribution allowed us to conclude that differences of LGM and control run indicies are mostly at the significant level [Sourkova, 2003].

On the base of calculated index we may say that zonal circulation changes 21 kyr ago had a strongly expressed features, especially in the southern hemisphere and in tropics (fig. 2).

In a southern hemisphere there is a displacement of an axis of the maximum of zonal western circulation to the south, while values of index maximum in this zone grow during the year on 850 hPa and since november till march on 200 hPa. In a tropical zone the maximum of east circulation is moved northward only on 850 hPa, but the intensity of east circulation on an axis of maximal values is less then for present-day climate within all year. On the 200 hPa situation of an axis of the most intensive east circulation differs from the current climate, but the intensity of circulation is increased along the axis during the year. The changes of zonal wind speed circulation of in a zone of the westerlies in northern hemisphere have the same features, as zone of western winds of a southern hemisphere, but they are expressed much less.

**References**

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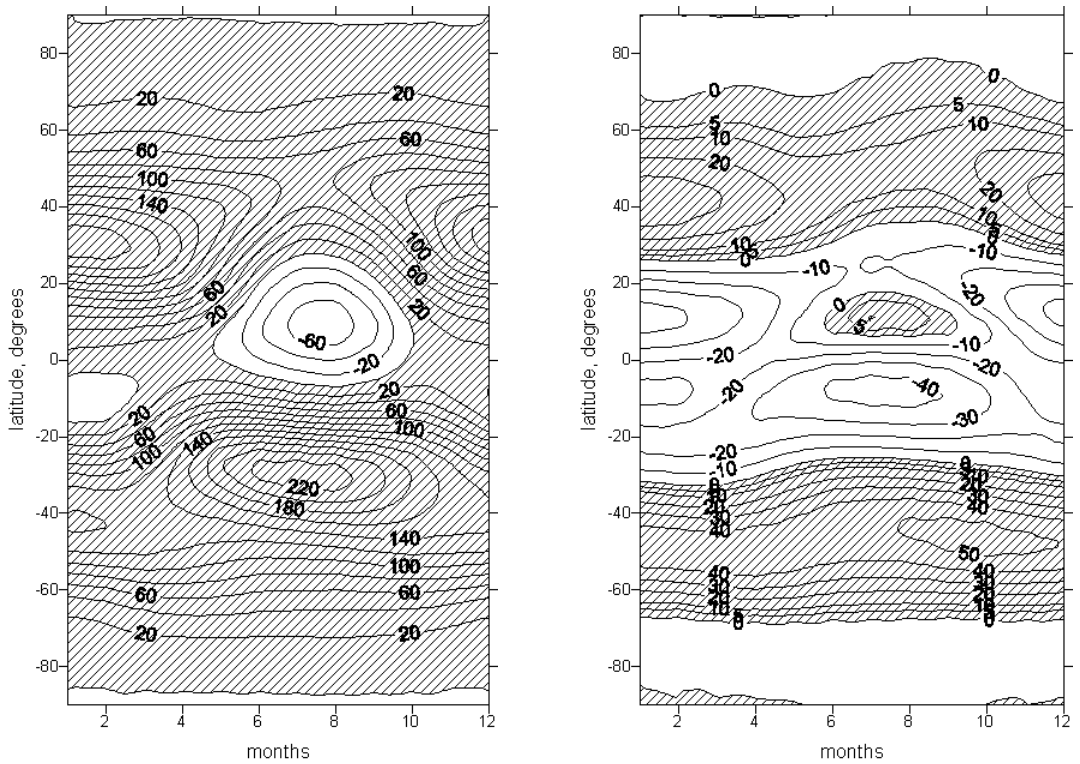


Fig.1. Annual changes of the zonal wind speed circulation index for the control run at 200 hPa (a) and 850 hPa (b)

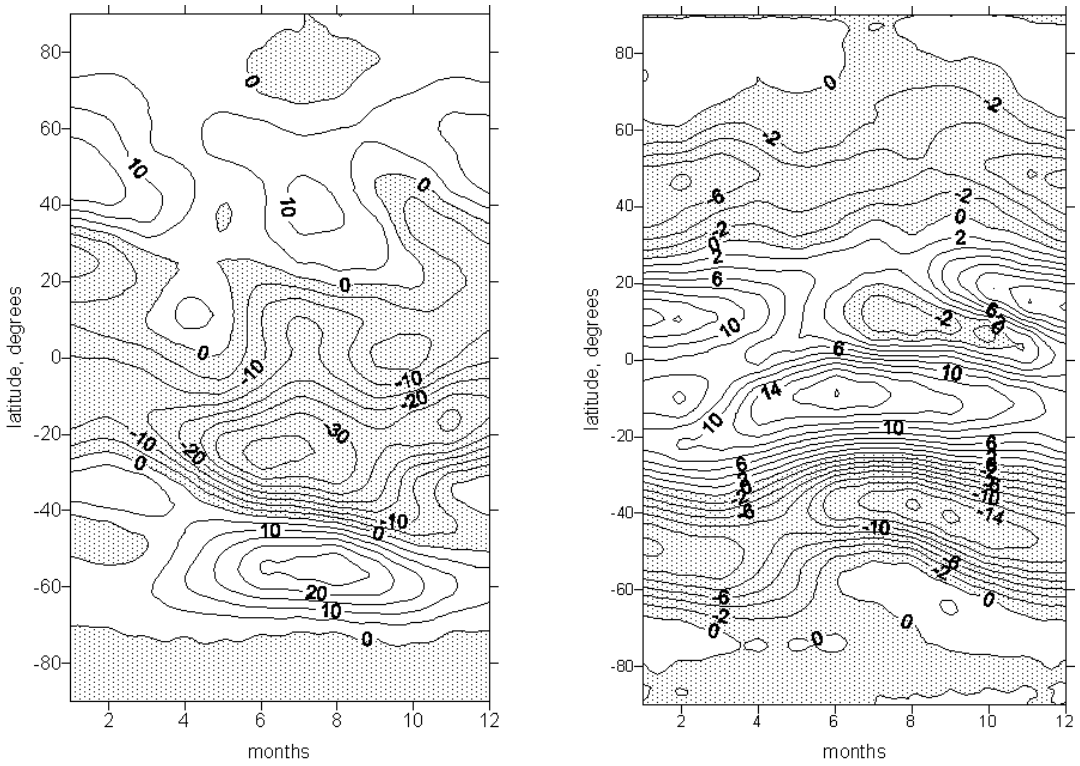


Fig. 2. Differences of the zonal wind speed circulation index between LGM and control run at 200 hPa (a) and 850 hPa (b)