Climate of the Past Discussions, 1, S142–S145, 2005
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Climate of the Past Discussions

Interactive comment on "Synoptic climate change as a driver of late Quaternary glaciations in the mid-latitudes of the Southern Hemisphere" *by* H. Rother and J. Shulmeister

Anonymous Referee #2

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General comments:

Understanding teleconnection between the northern and southern hemisphere is important to understand the dynamics of the climate system. Investigation on how the SH glaciers advance or retreat during the late Quaternary glacial periods can help us to understand the interhemispheric teleconnection. The Southern Alps of New Zealand are an interesting region for this kind of study.

By employing a glacial snow-mass balance model, this paper demonstrated that a moderate cooling on regional or synoptic scale, which could be produced by enhanced westerly, could generate large ice accumulation. This result shows that the relationship between advance/retreat of New Zealand glaciers and the large northern climatic

events is not straightforward.

However, some drawbacks exist in the current form of the paper. Here I list some major ones. It seems to me that the authors have some misunderstandings of the relationship between precipitation and humidity (see specific comments (9) and (10)). Also, the authors neglected a precipitation scenario of higher relevancy (see (11) below). Furthermore, in addition to relating the shift of westerly to ENSO, more discussion on the causes of the westerly shift and the moderate cooling are necessary, such as greenhouse gas forcing, possible re-organization of ocean circulation, and what eventually enhanced ENSO during LGIT, and so on, in order to have a more complete understanding of what are potential drivers of Quaternary glaciation over New Zealand.

Specific comments:

1) line 8 of Abstract: 'very little thermal forcing' should be 'moderate cooling' which is consistent to the rest of the paper.

2) last two line of Abstract: The authors should note that LGIT is not the same thing as Younger Dryas. It is vague to use LGIT to mean a specific climatic event, since during the deglaciation phase of the last glacial, both warm and cold events occurred in the northern high latitudes. The LGIT is used several times with the same problem in the rest of the paper.

3) page 2, line 13 from bottom: 'ELA' should be expanded here, not later.

4) page 2, line 12 from bottom: 'large scale cooling' is not clear. Does it mean large cooling by the authors?

5) page 3, line 1: when the teleconnection between the northern hemisphere and southern hemisphere is discussed, it is always necessary to describe the northern event. For example, what happened during 14.6-13.6 cal. 14C years in the northern hemisphere?

6) page 5, line 1: The authors mentioned 'enhanced ocean upwelling'. It should be

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pointed out where the upwelling is enhanced, instead of asking readers to go to the original reference to find the answer.

7) page 5, line 2: ‘maximal in dust flux have generally attributed to enhanced westerly flow during the LGM.’ To my knowledge, the dust concentration was high during the LGM. How can we know that a high dust concentration has relatively small contribution to the ‘maxima in dust flux’?

8) page 6, the footnote: Please clarify what is the attached d.o.i.?

9) page 7, last para.: Probably the authors mixed up the precipitation with the humidity. On large scale, humidity is basically a function of air temperature. Hence, humidity is reduced in a cold climate. However, in a cold climate, on regional (small) scale, precipitation can be enhanced by increased atmospheric moisture transport. A good example is that an enhanced westerly produced increased precipitation over the Southern Alps during the LGM on regional scale. A clarification is needed.

10) page 8, for scenario 1: again, on a regional scale, it is not the air mass saturation vapor pressure that determines the precipitation. Even on a large scale, cooling induced decrease of precipitation is not directly related to the drop of the air mass saturation vapour pressure. Reduced evaporation and possibly reduced atmospheric transport are two main reasons for the decrease of precipitation.

11) Since some references suggest wet conditions caused by enhanced westerly during the LGM, the authors need to use another precipitation scenario, i.e., scenario 4, to calculate the total snow fall in Fig. 4b. In this scenario, precipitation could be larger than the present value. From my point of view, this scenario is probably more realistic than others. If this scenario is included, total snowfall would be further enhanced in a moderate cold climate. This will hence strengthen the main point obtained in this paper.

12) page 9, line 13: ‘sensible heat’ should be ‘latent heat’ due to the freezing of rain.

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13) page 12, line 2 from bottom: Specifically, the climatic event at around 13 ka should be described briefly.

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