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Interactive comment on "Quantifying the effect of vegetation dynamics on the climate of the Last Glacial Maximum" *by* A. Jahn et al.

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We want to thank S. Levis for his helpful and encouraging comments in his review of our paper. We will address his questions and suggestions in the following. The suggested additional details in the methods section are discussed in the answer to M. Loutre's comments.

1. We apologize for misspelling the name of the referee and will correct this mistake in the revised version of the paper.

2. The analysis of the contribution of different factors to the LGM cooling in Ganopolski (2003) was performed using a somewhat different technique. Ganopolski (2003) performed five experiments: REF, LGM_C, LGM_{CI}, $LGM_{CIV(W)}$ and LGM_{CIV}. In $LGM_{CIV(W)}$, ocean model parameters were slightly modified to sustain the "warm" mode of thermohaline circulation (THC), which oth-

erwise is unstable under full LGM conditions. In Ganopolski (2003), the contribution of CO_2 was determined as the difference $LGM_C - REF$, the contribution of ice sheets as $LGM_{CI} - LGM_C$, the contribution of vegetation as $LGM_{CIV(W)} - LGM_{CI}$, and the contribution of the reorganization of the ocean circulation as $LGM_{CIV} - LGM_{CIV(W)}$. In this paper we use the standard factor separation by Stein and Alpert (1993) and consider vegetation as a feedback rather then a factor. This allows us to assess the response of vegetation to CO_2 and ice sheet changes separately. At the same time, some part of the climate changes attributed to individual factors in Ganopolski (2003) is now treated as a synergy between different factors. Thereby, the current study is complimentary to the previous work of Ganopolski (2003), and we will make this clearer in the revised version of the paper.

3. Section 2.1: "vertical layers" will be changes to "vertical levels" in the revised version.

4. Section 2.2, paragraph 1: The notation of the calculation of factor f_{CI} will be changed as suggested.

5. Section 2.2, paragraph 1: Since we did not treat vegetation as a factor in the sense of the factor separation technique, we only needed 4 experiments for the factor separation of CO_2 and ice sheets. We chose not to perform a factor separation for vegetation as well because we wanted to investigate the effect of vegetation feedbacks by using the interactive vegetation under different forcings. For the factor separation, however, we would have needed to fix vegetation at its present-day or LGM distribution; hence, we would not have been able to investigate the individual response of vegetation to lowered CO_2 and imposed LGM ice sheets. For the feedback analysis that we performed, we needed only three and not four more experiments because we calculated the vegetation feedbacks as changes caused by the interactive vegetation relative to simulations where vegetation was

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fixed (and the vegetation feedback to the synergy term by additionally subtracting the effects of the other two feedback terms from the difference between LGM_{CIV} and LGM_{CI}).

6. Section 2.2, paragraph 2: will be changed as suggested in the revised version.

7. Section 2.3: The gyre parametrization is described in Ganopolski and Rahmstorf (2001). A reference to this paper will be included in the revised version.

8. Section 2.3: will be changed in a similar way as suggested, based on comments by M. Loutre. See # 2 of the Author Response to M. Loutre's comments for the new formulation.

9. Section 3, paragraph 3: Rewrite this sentence to: "The stronger cooling in the high latitudes ("polar amplification") is caused by the positive sea-ice-albedo and snow-albedo feedbacks operating in both hemispheres."

10. Section 3, last sentence: will be changed as suggested in the revised version.

11. Section 4, paragraph 1: Climate-vegetation interactions were found to be stronger in cold climates than in warm climates by Brovkin et al. (2003), due to a shorter snow season in warmer climates that reduces the radiative effect of the taiga-tundra effect in northern latitudes. However, this not only applies to the last glacial and today, but also to the present-day climate versus the climate in global warming experiments.

12. Section 4, paragraph 2: "due to ocean effects" will be added as suggested in the revised version.

13. Section 4, last paragraph: we agree that the last paragraph should be deleted from the paper.

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