Reply to the comments of reviewer #2 on paper CLIDY-D-09-00146 "*Scale-decomposed atmospheric water budget over North America as simulated by the Canadian Regional Climate Model for current and future climates*" submitted by Raphaël Bresson and René Laprise.

This is an interesting paper which applies the methodology from Bielli and Laprise (2006) of decomposing the atmospheric water budget into different spatial scales by a Fourier transform. The analysis is performed on a climatological time-scale (30 years). The first part of the paper deals with present day climate and is basically a repetition of Bielli and Laprise (2007), except for a slightly different model set-up and different driving data. The news in this paper is the study of changes in the hydrological cycle for a future climate simulation.
The paper is in itself interesting, but it spends too much time repeating what has already been found in earlier papers, and too little time with the future climate analysis, which is the main contribution from this paper. I recommend that the paper is shortened, and that the main focus is moved from the control to the scenario simulation. I would further like to see a more critical analysis of the statistical significance in the climate change signals discussed, and some tests of this. I recommend major revision.

We thank this reviewer for his thorough review and several encouraging and constructive comments. In the revised version, the paper has been shortened by 5 pages and the number of figures reduced to 15. In particular the section on current climate has been cut down by 4 pages.

In the revised manuscript we emphasized that analysis of the scale-decomposed water budget for the current climate differs from the work of Bielli and Laprise in the version of CRCM used (with important land-surface processes changes), in the use of CGCM for driving the simulations rather than reanalyses, and in domain size.

The statistical local significance of climate-change projections has also been tested and discussed in the revised manuscript (see below).

Comments:
Abstract:
Only the last two sentences refer to the scenario simulations. This is the main news value of this paper and should be more pronounced in the abstract.

The abstract has been reworded and more space has been dedicated to climate-change projections.

Introduction:
"they suffer from several inaccuracies (windy weather, snow precipitation)". None of these are inaccuracies
on page 3. "These arguments however only hold on global scales" This is not true. Even though they might be overcome by local effects, this is not generally the case. For North America Gutowski et al (2007) have shown the change from low to higher intense precipitation with climate change.

The offending sentences have been reworded in the revised version of the manuscript. We have used instead of "inaccuracies" the term "errors". We have replaced the other sentence with "Locally many factors could influence the global evolution of the

precipitation pattern, such as…"

2.1 page 6
"A spectral nudging technique." The reason for using spectral nudging should be explained.

The large-scale spectral nudging of horizontal wind components is part of the standard configuration of this model as used by the Ouranos Consortium that performs the regional climate-change simulations for Canada. The fact that spectral nudging is only applied above the 500 hPa level implies that it has very little influence on our results for the vertically integrated moisture flux divergence, since the moisture is mainly confined in the low levels where water vapour is maximum.

3 Current climate
The text should be shortened here. E.g. the figure explanations should be kept to the figures, and need not be repeated over and over in the text. This makes for easier reading, and allows the author to put the results in focus instead of the figure explanations.

Section 3 has been shortened for the analysis of both the winter and summer seasons. The interannual variability is not dealt with anymore and the discussion has been reduced to the most important remarks.

As suggested the explanations of figures have been limited to the minimum necessary in the text and concentrated in legends. The number of figure has also been reduced, from 4 to 3 for each season. Some panels have been withdrawn (for each season: 4 panels concerning the interannual variability, as well as 5 panels showing the intraseasonnal variances of total water budget variables).

However we believe that the results for the current climate are worth being described again, since the configuration of the simulation used here is significantly different from the configuration of the simulation used by Bielli and Laprise (2007). We also believe that examining the results for the current climate helps the reader to better understand the future climate results. Therefore we kept figures displaying scale-decomposition results for the current climate.

4 Future climate
For most of the figures here I lack at least some kind of statistical significance test. A simple test would be to test for significant differences in the mean or variance in each grid point. Then only the differences significant to a set level should be plotted. This would make the important changes more visible and make it easier for the reader to assess the impact on the different variables investigated here.

We thank this reviewer for this excellent suggestion. In the revised manuscript, the local statistical significance level of climate change projections has been tested, using two tests. They have been performed at each grid point, in a two-sided configuration and with a 5 % rejection level. Firstly a bootstrapping test has been carried out for both the difference of the means (future minus current climates) and the difference of intraseasonnal variances. In the climate change section, only significant changes are now displayed and discussed, which allows us to focus on most important results. A t-test has

also been carried out; it gave results very similar to those of the bootstrapping technique.

We therefore are very confident in the correctness of the statistical significance test that has been performed.

4.2.2 page 25

"Contrary to winter, the summer small-scale variability changes often exceed the large-scale changes for precipitaiton" I do not see any strong proof for this in the figure. The small-scales often follow the large-scales, but has larger variability in the pattern. I doubt that a statistical test of the changes would yield any significant differences.

This remark referred to former Fig. 17 (now Fig. 14) and came from the comparison of large- and small-scale changes looking at a difference field (not shown in the article). Given that statistically significant small scales are actually very limited for precipitation (see Fig. 14), this remark has been removed in the revised version of the paper.

Language comments:

We thank this reviewer for the many suggestions he has made which helped to improve the quality of this manuscript. All of them have been considered in preparing the revised manuscript.