General Comments

The research presented in this manuscript calibrates and validates a modified version of the nutrient emission model MONERIS to a river basin in La Tordera, Spain. A detailed discussion regarding model inputs, calibration, uncertainty and sensitivity is presented. The researchers' primary objective was to validate the model for the La Tordera catchment in order to quantify spatial and temporal variability in nutrient loads from urban and rural areas within the basin. The findings of this research suggest that although nutrient emissions from the basin are declining, the majority of phosphorus emissions are from urban and industrial sources, while nitrogen export from agricultural areas within the basin is still a concern.

The research identifies some interesting points that upon further investigation should generate interesting and valuable conclusions. For example, the model results suggest a wide range of in-stream nutrient retention. These results are very important with regard to reducing nutrient export and some novel research questions could be investigated: Are there specific land-use types associated with the areas with low nutrient retention? How do physical characteristics of the streams with low nutrient retention differ from those with high nutrient retention? What, if anything, can be done to improve the in-stream retention of streams that currently have low retention? Although a more detailed discussion of the retention is provided on p. 7574 line 20 through p. 7575 line 15, these types of questions regarding spatial variability are not addressed and have important implications for land management. Such information would help agencies decide what management practices should be implemented and where they should be implemented in order to significantly reduce nutrient loads.

Additionally, the research suggests that "agricultural diffuse sources on nutrient loads remains a problem" (p. 7574 lines 10-11) despite decreases in fertilizer use (p. 7574 lines 3-6). Similar trends have been observed by other researchers for agricultural catchments and have very important implications regarding the best management practices likely to most effectively reduce nutrient export. Please refer to Basu et al., 2010 and Thompson et al., 2011 (references given below) and include an enhanced discussion of this aspect of the modeling results.

The manuscript should shift the focus away from model calibration, validation, and sensitivity and instead emphasize the implications of the research findings in terms of management strategies for reducing nutrient export. Specifically, the researchers should further investigate: (i) spatial variability of in-stream nutrient retention; (ii) reasons for the long-term impacts of agricultural land; and (iii) inter-annual variability of flow-weighted concentrations.

References:

Basu, N.; Destouni, G.; Jawitz, J. W.; Thompson, S. E.; Loukinova, N. V.; Darracq, A.; Zanardo, S.; Yaeger, M.; Sivapalan, M.; Rinaldo, A.; Rao, P. S. C., Nutrient loads exported from managed catchments reveal emergent biogeochemical stationarity. *Geophysical Research Letters* **2010,** *37* (L23404).

Thompson, S.E.; Basu, N.B.; Lascurain, J., Jr.; Aubeneau, A.; Rao, P.S.C., Relative dominance of hydrologic versus biogeochemical factors on solute export across gradients. *Water Resources Research* **2011**, *47* (W00J05).

Specific Comments

p. 7559 lines 8-10: Dominant soil type(s) should be included here.

p. 7559 lines 16 – 19: It would be helpful to provide a summary of the flow variability along with Figure 2, where the authors show annual precipitation box and whisker plots.

p. 7560 line 19: Readers should be referred to Figure 3 when the Forgars monitoring station is introduced.

p. 7562 line 20 through p. 7566 line 17: Moving this section from the main body of the manuscript to Supporting Information would help to make this manuscript much more concise.

p. 7563 lines 7-8: What are the dominant soil drainage classes in irrigated agricultural areas? If the soils are well-drained, it is highly unlikely that the area is tile-drained, whereas if the soils are poorly-drained, than the assumption of tile drainage is probably correct.

p. 7563 line 17: It is unclear what the authors mean by "good or poor porosity". Perhaps referring to the soil drainage class would be more beneficial to readers.

p. 7563 lines 20-24: This information should be moved to the Study Site section.

p. 7563 line 26: Use of the phrase "best judgment" is vague. The authors should attempt to describe how DARP and IRTA estimated values (*e.g.*, knowledge of past and current land use, types of crops grown on agricultural land, etc.?).

p. 7565 lines 3-4: How was precipitation used to make these estimations? What methods and/or assumptions were made and what validation was done to ensure these methods were appropriate?

p. 7568 lines 22-23: What criteria were used to assign a reliability rating for the input data? The ranking from 1-5 seems ambiguous without further discussion in this section of the manuscript or as additional information that could be added in the SI.

p. 7570 line 5: The E value prior to this change should be provided; "substantially improved the model fit" is not quantitative enough.

p. 7570 lines 9-13: The values reported for the range of N and P retention are actually quite large. It would be very interesting to investigate what areas in the catchment had the least retention and see if any connections can be made between land use and low retention.

p. 7573 lines 6-8: It has been discussed in previous sections of the manuscript that the model is particularly sensitive to precipitation. Of course, the precipitation varies from year to year, as does the amount of flow discharged by the catchment. The spurious relationship between load and flow suggests that simply comparing inter-annual nutrient loads is insufficient. Please calculate the annual flow-weighted concentrations (annual mass exported/annual flow discharge) and compare these values, as they remove the bias caused by inter-annual variations in flow.

p. 7474 lines 22-23: How much of the 50% reduction was nitrogen and how much was phosphorus?

p. 7577 lines 19-21: Although it is clear from the sensitivity analysis results that this statement is true, it is unclear how this statement translates to useful information for reducing nutrient export. For example, it is unlikely that inhabitants will decrease, that tile drainage will be removed, or that atmospheric deposition will decrease in the near future. Perhaps a more detailed discussion regarding the surplus of nutrients in the topsoil would prove useful.

Figure 1: The figure is cited as coming from the Catalan Cartographic Institute; however, the authors do not provide any documentation of permission from this institute to use this figure for publication.

Technical Corrections

p. 7558 line 18: catchment,

p. 7560 line 5: The phrase “land use change” is more suitable than “territorial change”.

p. 7561 line 4: The word “prohibited” is more suitable than “advised against”.

p. 7561 line 22: The word “sought” should be replaced by “thought”.

p. 7563 line 10: Replace “mapped” with “determined” or “calculated”.