

## ***Interactive comment on* “Linking an economic model for European agriculture with a mechanistic model to estimate nitrogen losses from cropland soil in Europe” by A. Leip et al.**

**A. Leip et al.**

Received and published: 26 September 2007

### **1 Response to technical and detailed comments**

#### **1.1 Technical comments of referee #2 (Authors need to carefully proof read the document):**

We are grateful to the referee to have made a large number of suggestions to improve the language of the manuscript. In the following we list only those suggestions which we have not transcribed one-to-one into the manuscript. All others will be fully considered in the revised version.

7. Page 2217 lines 12-13: suggested change “ranging from the differentiation of regional conditions to the accommodation of the effects of proposed mitigation measures.”

This would modify the intended meaning of the sentence. We propose instead: “. . . huge uncertainty range. In addition, they lack the ability for the differentiation of regional conditions and the accommodation of the effects of proposed mitigation measures”

9. Page 2217 lines 18-19: sentence is awkward “for example” is not needed and what does “in the frame of GHG inventories” mean?

Proposed modification of the sentence: “Process-based models can be used for reporting of greenhouse gas emissions from agricultural soils under the United Nations Framework on Climate Change Convention (Leip, 2005).

11. Page 2217, lines 22-27: The sentences are a bit awkward. I would consider rewriting to something like this, if the meaning is still relevant: “The main obstacle of using process based models as tools for policy impact assessment of agricultural, from the regional to national scale, is the difficulty in matching agricultural activities with environmental circumstances (references). The accuracy of simulating fluxes with process-based models, such as the DNDC (Denitrification Decomposition) model, is largely dependent on the quality of input data. DNDC has been shown to be especially sensitive to soil organic matter (SOM) content and nitrogen fertilizer application rates.”

Ok – but left “in agriculture” instead of “of agricultural” and “continental” instead of “national”

17. Page 2218, lines 23-24: But at a much lower scale than what? This project?

Yes, we suggest to modify this sentence into: “. . . but the area of interest is much smaller than in the present study.”

23. Page 2219, line 17: The first sentence in the methodology should instead provide a range of what the DNDC model can predict. The opening sentence is a bit awkward.

The sentence is changed to: “The DNDC (DeNitrification DeComposition) model predicts biogeochemistry in, and fluxes of carbon and nitrogen from agricultural soils.”

30. Page 2220, lines 21-22: suggested change: “The main purpose of CAPRI is to carry out a Pan-European ex-ante impact assessment” Sentence structure is poor.

Suggested change: “The main purpose of CAPRI is the Pan-European ex-ante policy impact assessment from regional to global scale. Policies considered are e.g. premiums paid to

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)

farmers, border protection by tariffs or agri-environmental legislation.”

*47. Page 2224, lines 21-22: Is “livestock unit” used as a common denominator for accounting for all animals? Sentence not clear.*

Suggested change: “The regression is applied to the 14 animal activities covered in the CAPRI data base as well as for livestock aggregates (ruminants, non-ruminants and all types of animals) on the basis of the livestock units.”

*54. Page 2227. line 10: please reword because the meaning is not clear*

Suggestion: remove sentence

*55. Page 2227, lines 16-28. Does this approach mean that some manure is being applied to all land units? It is more likely that manure is applied to only specific land areas. This type of generalized application may result in much different soil C dynamics than is actually occurring. What are the constituents of the applied manure?*

Please see answer to specific comment number 6.

*57. Page 2228, line 8: suggest; “Scheduling of tillage and fertilizer applications”*

*58. Page 2228, line 10-11: please reword, unclear*

*59. Page 2228, line 11: replace actually with actual*

Paragraph re-phrased to: “Scheduling of crop management is calculated by applying pre-defined time lags between crop sowing and tillage or fertilizer applications, respectively. These are obtained from the DNDC farm library (Li et al., 2004)”

*60. Page 2228, lines 14-19: What was the pre-defined setting for irrigation, field capacity? Also, what was the frequency of irrigation events?*

Sentence re-phrased to: “The DNDC model treats irrigation such that a calculated water deficit is re-plenished whenever it occurs.”

*61. Page 2228, 21-23: Considering the highly variable effect that tillage has on GHG emissions it would be a good idea to simulate intensive, minimum and no-tillage systems and apply results back to the percent of each tillage practice in the land area.*

Please see answer to specific comment number 5.

**BGD**

4, S1511–S1517, 2007

---

Interactive  
Comment

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

64. *Page 2229, line 10: MARS was not previously defined*

Changed to “Institute for Protection and Security of the Citizen”

65. *Page 2229, lines 10-11: It is a concern that GHG estimates are only being determined using one year of weather data. Interannual variation in emissions can be very large, even for a large land mass.*

Please see answer to specific comment number 5.

66. *Page 2229, line 15: suggested change; “rasters were processed using pedo-transfer functions”*

67. *Page 2229, line 20: “contains under others” is unclear*

68. *Page 2230, line 1: replace “has been” with “was”*

Section 2.5.3 on soil data has been re-worded

84. *Page 2234, line 12: refer to previous statements regarding manure*

Please see answer to specific comment number 6.

100. *Page 2237, line 1: “class for? rice”*

Yes, Rice Fields are an explicit class in Corine at the level 3 nomenclature (under 2.1 Arable land, next to non-irrigated and permanently irrigated arable land).

104. *Page 2239, line 3-4: suggest; “simulated nitrogen uptake is approximately equal to the total input of nitrogen by fertilizer application, nitrogen fixation and nitrogen deposition E” Also, what about manure N?*

ok – was meant to be included in ‘fertiliser’, now added explicitly.

110. *Page 2241, lines 7-9: suggest; “E modeling units, in a similar manner to what we had seen for carbon stocks. While initial N<sub>2</sub>O fluxes were 17 kg N-N<sub>2</sub>O ha<sup>-1</sup> y<sup>-1</sup>, they were reduced after the 100yr simulation to”*

111. *Note that this section could be condensed to a couple of sentences.*

In the revised version this section will be considerably shortened.

125. *Page 2244, line 20: define or cite reference for HRU/ISU*

Specification of HRU/ISU not required here – deleted.

**BGD**

4, S1511–S1517, 2007

---

Interactive  
Comment

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

140. Page 2250, line 25-26: you state “from the land use that had defined the soil Characteristics” I don’t think land use defines soil characteristics. Shouldn’t it be the other way around?

Soil characteristics definitely define the way the land is used, but land use also has its impact on soil characteristics. However, in the above sentence we were referring to the method the soil data were derived, which includes information on land use. To make this clearer in the text we suggest the following modification: “Inconsistencies might particularly arise if the land use estimated in the present study differs largely from the land use that was used in the derivation of the soil characteristics.”

145. Page 2253, line 8: “simulation also with” or remove the “a” before posterior

ok – in the manuscript *a posterior* was meant in contrast to *ex ante* simulations. However, this is not required here and was deleted.

## 1.2 Some more detailed comments of referee #4

1. p.4: What about the IMAGE model? In the discussion it is mentioned, but would also be appropriate here. This section could be shortened, the English should be improved.

OK. The introduction has been completely revised and shortened; IMAGE is mentioned.

2. p.8, last para: bad English, unclear explanations

OK. Paragraph has been completely rewritten.

3. p.12, first para: unclear to me (see general issue above). Is the production from CAPRI downscaled as input for DNDC? Why is WOFOST needed in this context, and what exactly does DNDC itself?

Agreed. Paragraph has been rewritten and clarified.

4. p.13, last para: unclear English

Paragraph “Mineral application rates . . .” has been modified

5. p. 14: with regard to irrigation: weighting of irrigated area according to certain crops could be useful and maybe more realistic than fixed shares. But good information on this is probably scarce.

Agreed. We are currently working on a methodology to consider crop-dependent irrigation rates.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

6. 2.6.1.: unclear to me, this seems to a bit like insider information for DNDC users.  
Agreed. This section might not be required and we suggest remove it from the paper.
7. 2.6.2.: while the use and creation of HSMUs is covered in detail, the description of MSUs is a bit short and the principles remain unclear to me.  
Description of the MSUs has been re-written.
8. *p.17, last para: unclear formulation*  
OK. Re-written.
9. *p.18, last para: English to be improved; to me one statement remains unclear: EU-12 have higher shares of agricultural land, but are less intensive? Isn't it the other way round, i.e. higher shares in ag. land imply more intensive agriculture? Or do you combine area share in input use (fertilizer) in your statement here?*
10. 3.2. is rather long, could be shortened.  
Admittedly, the term “intensive” is misleading when speaking about land use shares only. The paragraph has been revised omitting this term and the whole section is shortened.
11. 3.2.1.: I like this validation approach, but coverage is too long  
We shifted the validation into the appendix
12. 4.1: good discussion!
13. 4.2.: good discussion, but why can this not been done for Europe?  
The challenge would be to cover all crops considered in the present study rather than the geographical extent. Nevertheless, considering the need to shorten the paper, we propose to remove the excursion into the discussion of studies that used space-borne data for assessing crop phenology.
14. 4.3.1: the IFA data on crop-specific nutrient use are, as far as I can tell, not official statistics, but taken from farm management recommendation and best practices. This should be taken into account when they are used for model calibrations or validations.  
This is not correct. The data are the result of questionnaires rather than recommendations. The section does not intend to validate the estimated fertilizer application rates, but rather to compare the numbers. As explained in the revised text, regional effect of the distribution of the animals on fertilizer application rates are ignored in the IFA data and

deviations are thus depending on the location of the crop land in relation to the stocking density of animals and the soil quality in the region.

15. 4.3.3: as it is mentioned by the authors, the quality of the detailed results from this modeling approach is limited by available data, especially soil data. Given these constraints, what can the new approach (and thus the paper) contribute to the debate in addition to e.g. EFEM-DNDC approach? That should be further clarified.

*EFEM-DNDC regards only one State in Germany where a detailed soil map was available. This can not be compared to our study which covers the whole European Union. We explained in section 4.4 that the land use map used in EFEM-DNDC is derived from Corine applying a correction factor to match the total areas of the Corine-classes, while our approach takes observations from the LUCAS survey into account through a complex approach described in section 2.3.1. Additionally mineral fertilizer and manure nitrogen application rates are estimated for each polygon in consistency with both the environmental and economic conditions, which is not the case in EFEM-DNDC.*

---

Interactive comment on Biogeosciences Discuss., 4, 2215, 2007.

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)