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## ***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.**

### **Anonymous Referee #4**

Received and published: 27 August 2007

The paper touches important topics and provides a high level of detail in coupling an economic agricultural sector model with a biophysical model focusing on nitrogen deposition. In the beginning the paper discusses well the issues on scale mismatches in available statistics and required model inputs. Also regional vs. local-level environmental problems and suitable modeling approaches are appropriately discussed.

In my view the paper is mainly a validation paper on the model coupling procedure, technical aspects and data preparation, downscaling and management between the two models. As is pointed out in the end, the focus here is (not yet) on model application and scenarios. So in parts of the paper it seems a bit early for such a publication

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without having some scenario results at hand. The authors do well acknowledge further work needed in the discussion part. So it is up to the editors to decide whether this strong focus on validation is worth publishing. The title to me promises a bit more than the paper actually holds. Instead, the description of data handling, downscaling and model coupling is described in much detail, in parts too long from my perspective. Maybe some subchapters in chapter 2 and 3 could be moved to appendices (or supporting online material) to make the paper better accessible without dropping the details. To make it clear, I think this work has great potential and is carefully done. The question is, is it already mature enough for a paper which demonstrates the modeling approach, related data issues and first results.

Two general points remain unclear to me:

(a) What is actually calculated by which model? As I understand, crop yield is taken from CAPRI and used as an input in DNDC. But then, DNDC is a process model calculating biomass and related nutrient flows. So, isn't yield of harvested organs also calculated within DNDC? For me the "workflow" between the models needs clarification here.

(b) In the end, the paper talks about 99-year simulations, which confuses me. Are these just "synthetic" scenarios to calibrate DNDC (or bring the model into equilibrium, or something else)? At another point it is said, that future application of the coupled modeling framework will probably cover a time span of 10 years. So what input is taken from CAPRI for the 99-year simulations. Possible structural limitations of CAPRI for long-term projections are not discussed.

Some more detailed comments:

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.

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

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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?

p.13, last para: unclear English

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.

Section 2.6.1.: unclear to me, this seems to a bit like insider information for DNDC users.

Section 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.

p.17, last para: unclear formulation

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?

Section 3.2. is rather long, could be shortened.

Section 3.2.1.: I like this validation approach, but coverage is too long

Section 4.1: good discussion!

Section 4.2.: good discussion, but why can this not been done for Europe?

Section 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.

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Section 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.

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

**BGD**

4, S1267–S1270, 2007

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