Atmospheric Chemistry and Physics Discussions

Interactive Comment

Interactive comment on "N$_2$O release from agro-biofuel production negates global warming reduction by replacing fossil fuels" by P. J. Crutzen et al.

P. J. Crutzen et al.

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It has not been the intention of our manuscript (Crutzen et al., 2007) to criticize the IPCC methodology to underestimate N$_2$O emissions from agriculture. Instead, we wish to point out that a direct application of this methodology to assess emissions due to biofuel production may lead to serious underestimation of the consequences of the reactive nitrogen released.

Ammann et al. (2007) point out that the cycling of reactive nitrogen in the environment may lead to several stages of N$_2$O formation, considered separately by IPCC (2006) but in one step in our paper. However, considering the huge uncertainties (see our response to Donner, 2007) we would be hesitant to apply a single emission factor to

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just one of these stages. Furthermore, accounting only for the direct & indirect emissions associated with the very first step of introducing fresh reactive nitrogen into the environment, and neglecting the subsequent fate of the N would ignore the emissions associated with subsequent transformations. We (in Crutzen et al., 2007) assume that biofuel production is performed in addition to current agriculture, and therefore will be based on freshly formed reactive nitrogen. We are aware that the integration and optimization of processes is possible, including use of nitrogen in crops for further agricultural production (animal husbandry, manure application to replace further application of mineral fertilizer). But we assume biofuel production to occur under current agricultural practices, worldwide, and consider the subsequent fate of nitrogen a direct consequence of its first application. There may be delays, after the fertiliser N application, before further indirect emissions take place (Bakken & Bleken, 1998; Mosier & Kroeze, 2000), but nonetheless there *is* a link, and we think it desirable to include these later emissions in our overall calculation.

Unless specifically shown, we are afraid that an optimization towards minimizing N_2O emissions will not occur by itself. Here we find ourselves in full agreement with Ammann et al. (2007), but also with Conen (2007) whose comment points very much in the same direction.

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