

Interactive comment on “Are ammonia emissions from field-applied slurry substantially over-estimated in European emission inventories?” by J. Sintermann et al.

Anonymous Referee #1

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General comments

The paper gives a very useful overview of the methods used to measure ammonia emissions from field-applied manure and raises important questions concerning the interpretation of the results of experiments undertaken over the last 20 years. The paper is generally well-written, particularly regarding the details of the methodologies. However, the end of the paper (sections 3.6 and section 4) is weak and does not do justice to the work that has been undertaken.

Specific comments – The authors have examined the effect of plot size on the emissions measured yet many other variables recorded in Table A1. Is it not worthwhile

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examining the influence of some of these other variables? – It would be valuable if the authors commented on the usefulness of the various methodological approaches for different objectives (e.g. are small-scale approaches adequate for comparing the relative efficiencies of different abatement measures?) and whether there is sufficient information to recommend that some techniques should be abandoned completely. If this is the purpose of the new series of measurements comparing emissions from medium and large scale plots proposed by the authors, it should be stated. – Do the authors consider that a better understanding of the mechanisms underlying the differences in measurements between plot sizes might allow the results of earlier experiments to be used in the derivation of emission factors in the future? – The comparison of the initial volatilisation rate using a Michaelis Menton and a mechanistic approach is interesting. However, for broadcast slurry that is not incorporated, the parameter of interest in the Michaelis Menton equation is N_{max} , which is only partially related to the initial volatilisation rate. This should be mentioned. A discussion of the validity of the initial volatilisation rate as predicted using the Michaelis Menton approach is much more relevant when considering the effect of the time between application and incorporation on the reduction in ammonia emission achieved. – The authors state that current emission inventories need to be updated to reflect the findings of the new generation of field scale ammonia emission measurements. This implies that there are sufficient data collected using the latest generation of measurements to achieve this objective. I do not think this is the case. Deriving generalised emission factors from specific field experiments is not straightforward. The total cumulative ammonia emission from a particular slurry application depends on the chemical characteristics of the slurry (particularly pH, TAN and dry matter contents), meteorological conditions, crop cover, soil conditions (affects infiltration rates) and application technology (although only broadcast spreading is in focus here). Derivation of a European average emission factor needs to take into account both the mechanisms driving ammonia emission and the conditions under which slurry is applied in practice. The data collated by the authors might be representative of European practices and conditions but probably is

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not; most of the data appears to have been collected in northern and western Europe. The reader should be warned that both good models and representative input data are necessary to obtain a representative emission factor for Europe. In section 2.4.1, the authors could point out that the negative relationship between N_{max} and the TAN concentration in the slurry in the ALFAM model runs counter to our understanding of the mechanisms underlying ammonia volatilisation. A proportion of the ALFAM dataset was reanalysed and an alternative model developed (see Lim et al (2007), *Europ. J. Agronomy* 26 425–434). This would be worth considering as an alternative to the original model. I would question whether Fig 1 is necessary. Fig 2 is adequate to convey the message to the reader. The word ‘animal housing’ should be used instead of ‘stables’. The authors state that ‘it is assumed that the calculated emission levels, together with the modelled atmospheric chemistry and disposition, successfully predict the measured ambient concentrations’. There has been much discussion of the ‘ammonia gap’ between predicted and measured concentrations; if the situation is resolved then a scientific reference should be used here. The authors ignore slurry injection as an abatement technology. The term ‘sticky’ is commonly used amongst practitioners to describe the tendency of ammonia molecules to temporarily bind to solid or liquid surfaces within sampling lines. I think it is acceptable to use this shorthand term, provided it is explained when first used.

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