

Development and comprehensive evaluation of DNDC

– New Zealand as case study

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Abstract: The use of the process-based DNDC (Denitrification-Decomposition) model has emerged as a promising route to predicting nitrous oxide (N₂O) and methane (CH₄) emissions from terrestrial systems (cropping, pastures and forestry), primarily at a local scale with subsequent application on larger spatial scales at the regional, national and sub-continental levels. The DNDC model can be used to assess the impact of potential GHG mitigation strategies not only on the target gases but also on other environmental factors such as soil C, NO₃⁻ leaching, NH₃ volatilisation.

Areas vital for the performance of process-based models are i) adequacy of incorporated process, ii) correct parameterization of quantitative relationships between the processes and their drivers, and iii) sufficiency and accuracy of model input data (Li 2009). Deficiency in any of the three aspects would inherently induce deviation of the modelled results and hence, uncertainty. The development of DNDC and other simulation models of soil-atmosphere exchange of N₂O, CH₄ and CO₂ build on many of the recent studies focussed on parameterizing and validating models. Within New Zealand, the DNDC model has been adapted by Landcare Research to grazed perennial pasture systems (the modified model is referred to as NZ-DNDC). This presentation will outline the research related to the development and evaluation of this model from paddock scale to regional- and national-scales to develop GHG inventories, assess the impact of mitigation strategies and to understand trade-offs and impacts of land-use change and intensification on greenhouse gas emissions and other ecosystem services.