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- Volumes and Issues**
- Special Issues
- Library Search
- Title and Author Search

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[Volumes and Issues](#) [Contents of Issue 4](#) [Special Issue](#)

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Testing the INCA model in a small agricultural catchment in southern Finland

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Abstract. Nutrient leaching from agricultural production is still recognised as a major environmental problem in Finland. To estimate agricultural nitrogen loading under changing land-use and climate conditions, the Integrated Nitrogen Model for Catchments (INCA) was applied in Savijoki, a small (15.4 km²) agricultural catchment, which represents the intensively cultivated areas in south-western Finland. Hydrological calibration and testing of the INCA model was first carried out in Savijoki during 1981–2000. In spite of heterogeneous soil and land-use conditions, INCA was able to reproduce the overall hydrological regime in the stream. The model was calibrated further in respect of nitrogen processes during 1995–2000. The model was able, reasonably well, to simulate the overall annual dynamics of the inorganic N concentrations in the stream water and the annual N export from the catchment. The average simulated NO₃-N export was 550 kg N km⁻² yr⁻¹ and the observed one (constituting more than half of the annual total N export) was 592 kg N km⁻² yr⁻¹. For NH₄-N, the simulated export was somewhat higher than that measured but NH₄-N was only 4% of the total N export. In spite of some underestimation of flow and N concentration during extreme hydrological conditions, the INCA model proved to be a useful tool for analysing flow pattern and inorganic nitrogen leaching in a small agricultural catchment, characterised by a rapid response to rainfall.

Keywords: nitrogen, integrated modelling, hydrology, catchment, agriculture

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