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# Dynamic modelling of the long term behaviour of cadmium, lead and mercury in Swiss forest soils using CHUM-AM

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### Highlights

- Measured and modelled Cd, Pb and Hg concentrations were similar in solid phase and in soil solution.
- The long term behaviours of concentrations of Cd and Pb vary between forest soils.
- The contents of Hg will further increase in all studied forest soils.
- The proposed critical limits for Cd and Hg will be partly exceeded by the proposed critical loads.

â€¢ The proposed critical limits for Pb will rarely be exceeded by the proposed critical loads.

## Abstract

The applicability of the dynamic soil model CHUM-AM was tested to simulate concentrations of Cd, Pb and Hg in five Swiss forest soils. Soil cores of up to 50 cm depth were sampled and separated into two defined soil layers. Soil leachates were collected below the litter by zero-tension lysimeters and at 15 and 50 cm soil depths by tension lysimeters over two years. The concentrations of Cd, Pb and Hg in the solid phase and soil solution were measured by ICP-MS (Cd, Pb) or CV-AFS (Hg). Measured metal concentrations were compared with modelled concentrations using CHUM-AM. Additionally we ran the model with three different deposition scenarios (current deposition; maximum acceptable deposition according to the Swiss ordinance on Air Pollution Control; critical loads according to CLRTAP) to predict metal concentrations in the soils for the next 1000 years. Assuming current loads concentrations of Cd and Pb showed varying trends (increasing/decreasing) between the soils. Soils rich in organic carbon or with a high pH value showed increasing trends in Cd and Pb concentrations whereas the concentrations in the other soils decreased. In contrast Hg concentrations are predicted to further increase in all soils. Critical limits for Pb and Hg will partly be exceeded by current loads or by the critical loads proposed by the CLRTAP but the critical limits for Cd will rarely be reached within the next 1000 years. In contrast, maximal acceptable deposition will partly lead to concentrations above the critical limits for Pb in soils within the next 400 years, whereas the acceptable deposition of Cd will not lead to concentrations above the proposed critical limits. In conclusion the CHUM-AM model is able to accurately simulate heavy metal (Cd, Pb and Hg) concentrations in Swiss forest soils of various soil properties.



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## Keywords

Critical limits; Critical loads; Cadmium; Lead; Mercury; Modelling soil concentrations

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