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Reporting of GHGs from mineral soils using models

Anu Akujärvi (Syke, ETC-CA)

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GHG emissions from mineral soils

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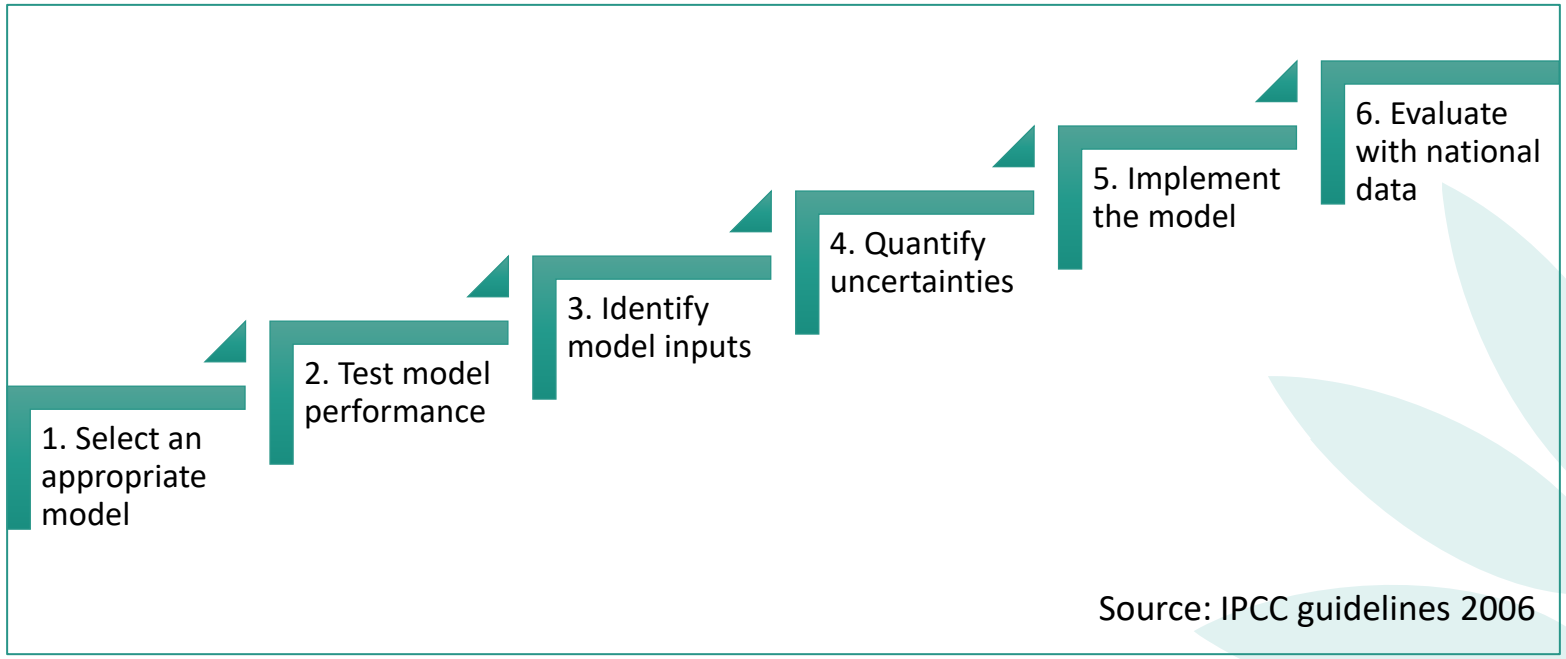
The decomposition of soil organic matter releases CO_2 to the atmosphere.

The CO_2 emissions are calculated based on the change in the soil organic carbon (SOC) stock, which depends on the balance between plant litter production and decomposition.

- Tier 3 methods consider the annual variation in soil carbon fluxes and the impacts of dynamic drivers, such as weather, land use change and land management practices.
- We investigated the use of models in the MS based on the 2024 national inventories, and collected information about model structure, input and output data, spatial and temporal resolution etc. per land use category.
- This presentation will summarize the findings from the review and the key areas of improvement identified in the work.

Steps of adopting a model



- Adopting a model-based inventory requires specific knowhow and expertise compared to the implementation of IPCC default emission factors, hindering their use.
- However, we hope that the shared knowledge on methods and good practices from the MS enhance the development of soil GHG inventories across the EU.

Summary of the findings

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Model name	SOC pools	Model inputs	Land use category
CBM-CFS3	Separate deadwood, litter and soil C pools	Annual mean temperature, litter turnover of biomass components	Forest land (CZ, IE)
C-TOOL	Fresh, humified and resilient soil organic matter	Monthly mean temperature, humidity, yearly litter and manure input, soil clay content, soil C:N ratio, (atmospheric ^{14}C content)	Cropland (DK)
ICBM-region	Young and old soil C pool	Daily temperature, precipitation and potential evapotranspiration, annual litter input, soil texture	Cropland (SE)
RothC	Four active pools of soil organic matter and one inert pool	Monthly mean temperature, precipitation, potential evapotranspiration; soil clay content, soil depth, litter input	Cropland (NL)
Yasso	Combined deadwood, litter and soil C pool, divided into five chemical components	Annual or monthly mean temperature, temperature amplitude and precipitation, litter input, chemical quality of litter, size of the woody litter	Forest land (AT, FI, DE) Cropland (FI) Grassland (FI)

What kind of activity data is needed?

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Time-series data from 1990 to present

Data availability differs due to differences in the forest and agricultural inventory systems.

Systematic soil carbon stock monitoring is rare.

- Annual land use and land use change in each category;
- Forest inventory data, growth and yield data, harvest removal statistics to estimate the litter input to soil, data on natural disturbances;
- Agricultural statistics to estimate the amount of crop yield, crop residues and animal manure

Areas of improvement

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The major development needs are related to activity data and model validation with independent data.

- The reliability of the estimated SOC stock changes could be improved by harmonized validation practices utilizing data from comprehensive SOC stock inventories;
- Uncertainty assessments of the modelled SOC stock changes by stochastic simulations account for the uncertainties in model input data and parameters;
- In general, model comparison studies could provide insights into the driving factors of SOC stock changes and their uncertainties in the MS.

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Thank you!

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