The contribution of dissolved organic carbon export to the carbon budget in the conterminous United States

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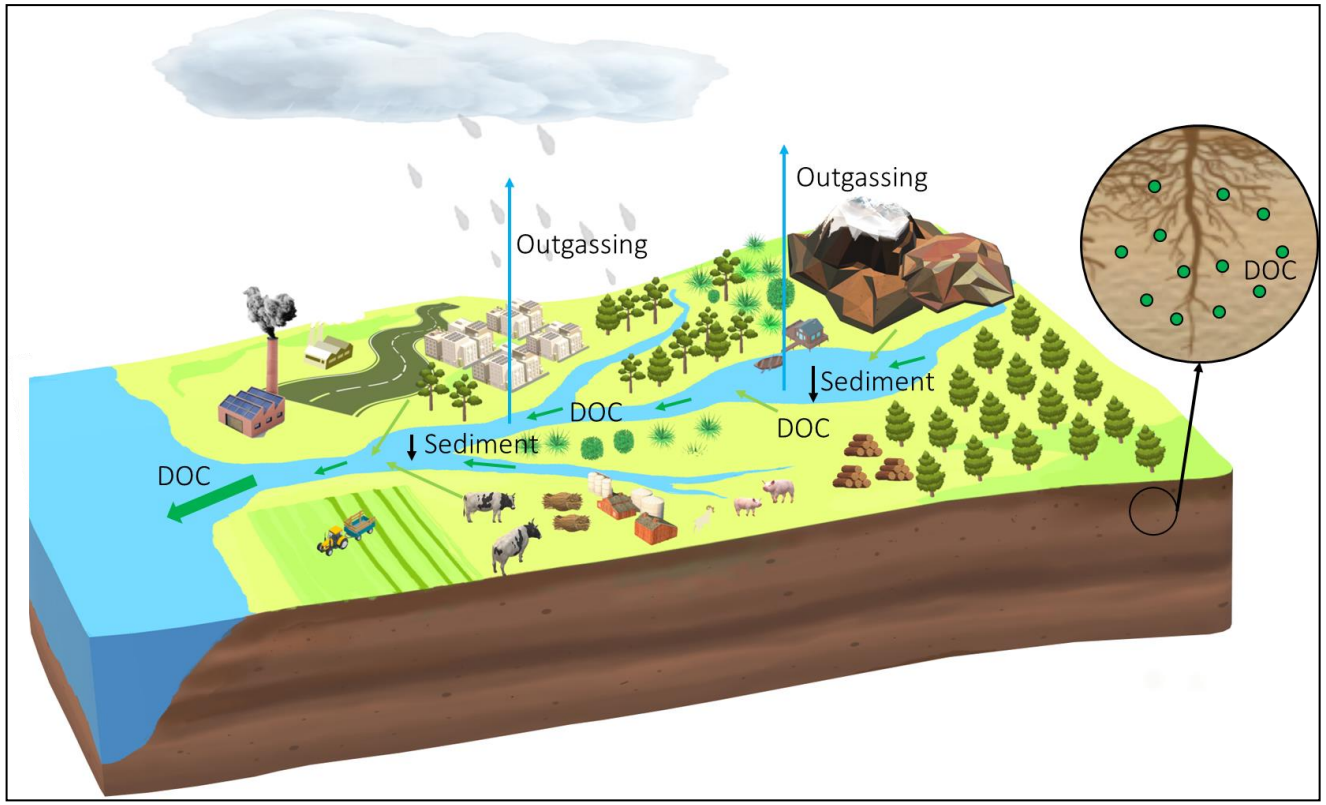
Lateral flux of dissolved organic carbon (DOC)

Introduction

The lateral flux of dissolved organic carbon (DOC) from soils to inland waters and ultimately to the ocean represents a fundamental component of the global carbon cycle.



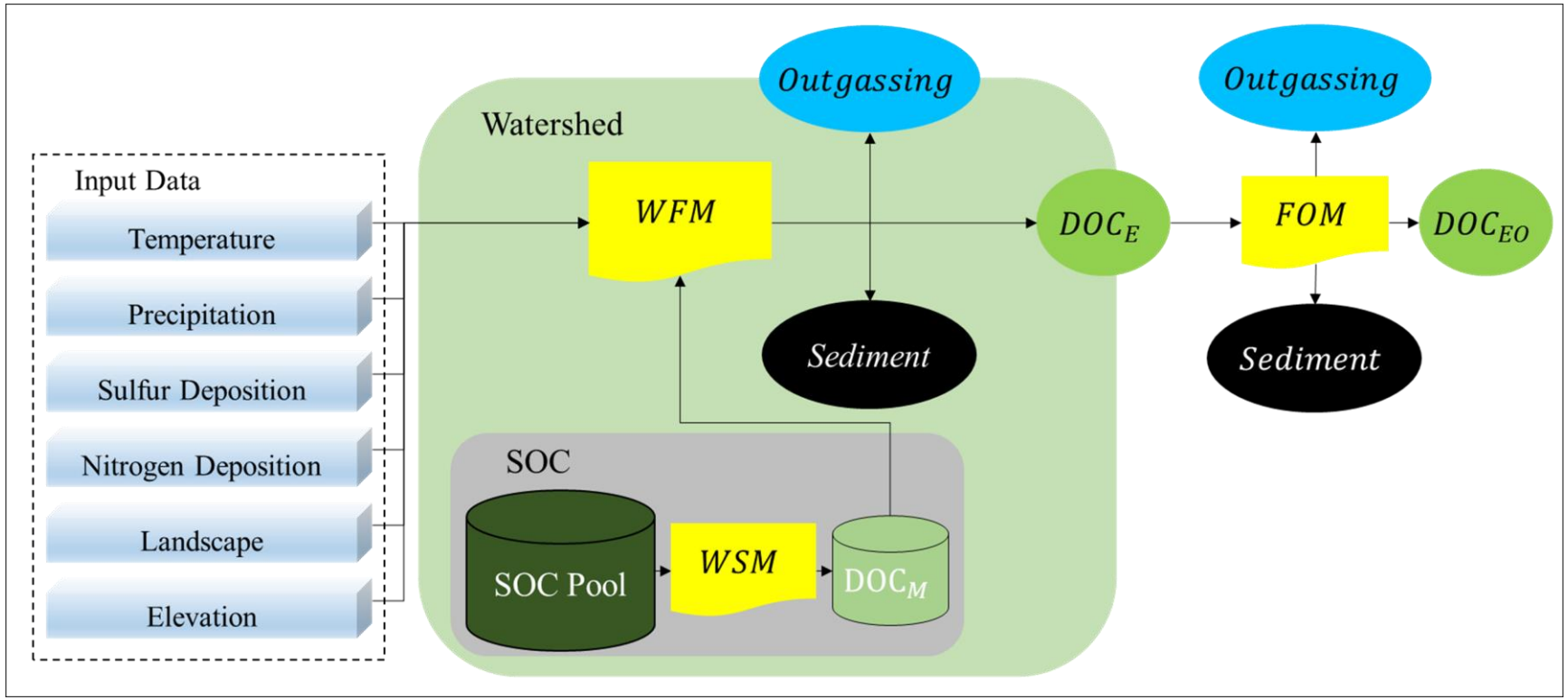
DOC Production

1. Incomplete decomposition of soil organic carbon.
2. Production of vegetation root exudates.
3. Washout of organic compounds in throughfall.

Objective

To estimate the delivery and potential fates of DOC flux from terrestrial through aquatic ecosystems to the ocean, we developed an empirical terrestrial-aquatic DOC fluxes model (TAF-DOC). TAF-DOC incorporates various environmental factors (e.g., meteorology, sulfur, and nitrogen deposition).

Structure and workflow of the empirical terrestrial-aquatic DOC fluxes model (TAF-DOC)

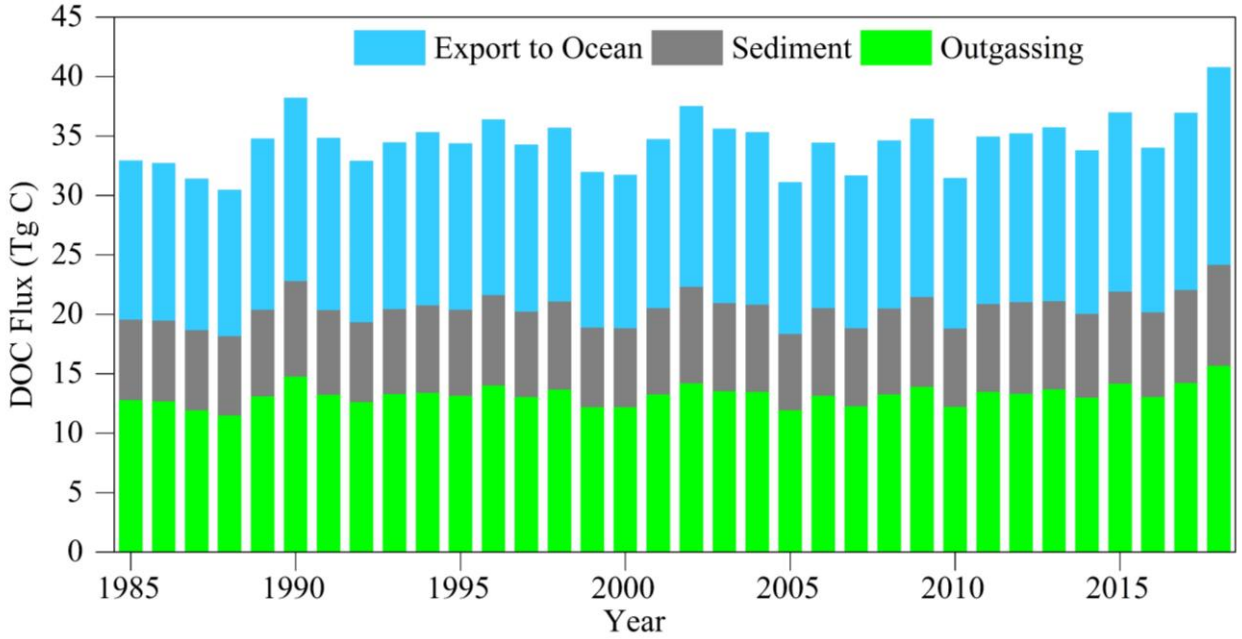


Model Application

TAF-DOC was applied to estimate spatial-temporal dynamics of DOC flux and potential fates across the conterminous United States during the 1985 to 2018 time period.

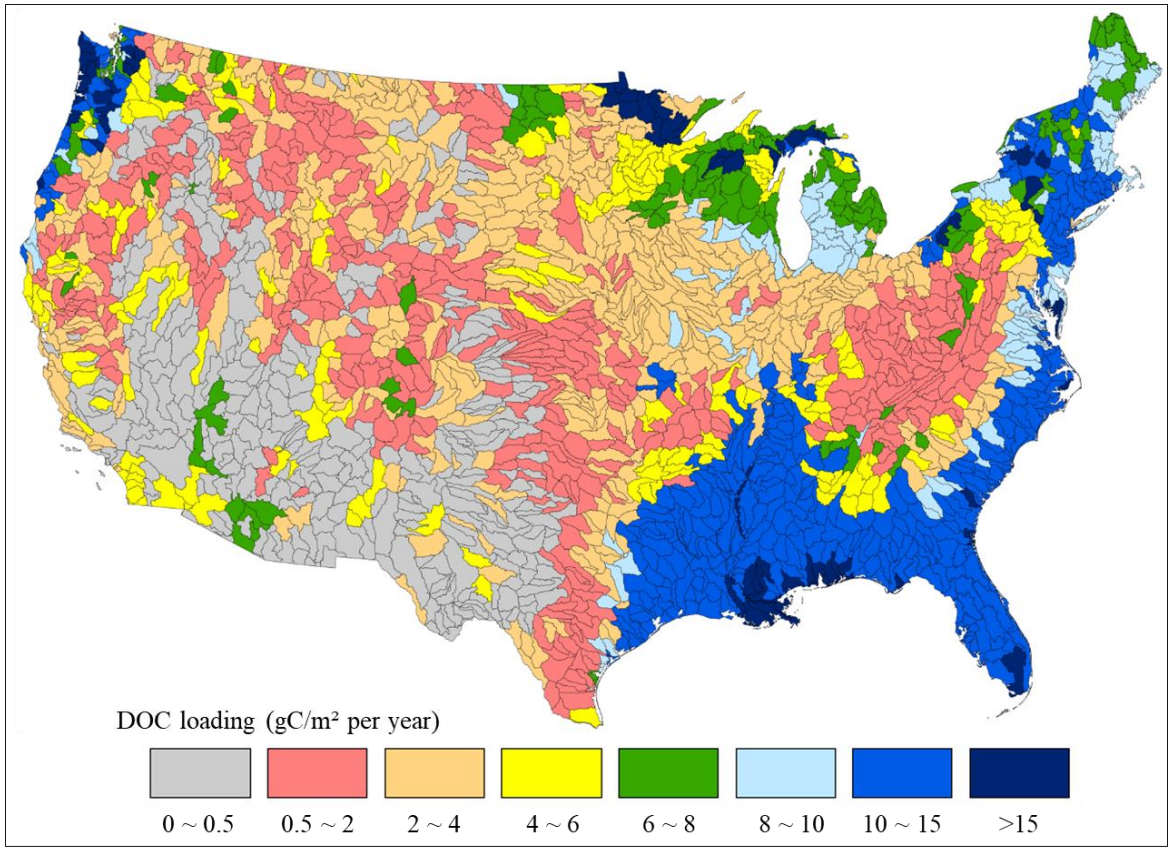
Structure and workflow of the empirical terrestrial-aquatic DOC fluxes model. SOC is the soil organic carbon, and DOCM is the DOC can be moved from soils to inland waters. DOCE is the DOC exported from the watershed. DOCEO is the DOC exported to the ocean. WSM is the Watershed Soil DOC Module. WFM is the Watershed DOC Fluxes Module. FOM is the Flux to the Ocean Module.

Results and Conclusions



The estimated DOC loading from terrestrial to aquatic ecosystems to be 33.5±2.2 TgC per year, which was roughly 0.39-0.49% of total soil organic carbon stock estimates.

The dominant fate of terrestrially-derived DOC was delivery to the coastal ocean in riverine export (41%), with another 21% buried in sediment and the remaining 12.9±0.4 TgC per year (38%) returned to the atmosphere through outgassing from inland waters.



The contribution of each watershed to the DOC export from the conterminous United States to oceans in the period of 1985-2018. The estimated DOC flux from soils to inland waters of these 2110 watersheds ranged from 0.1 to 25.7 gC/m^2 per year with a mean of 4.4 gC/m^2 per year.

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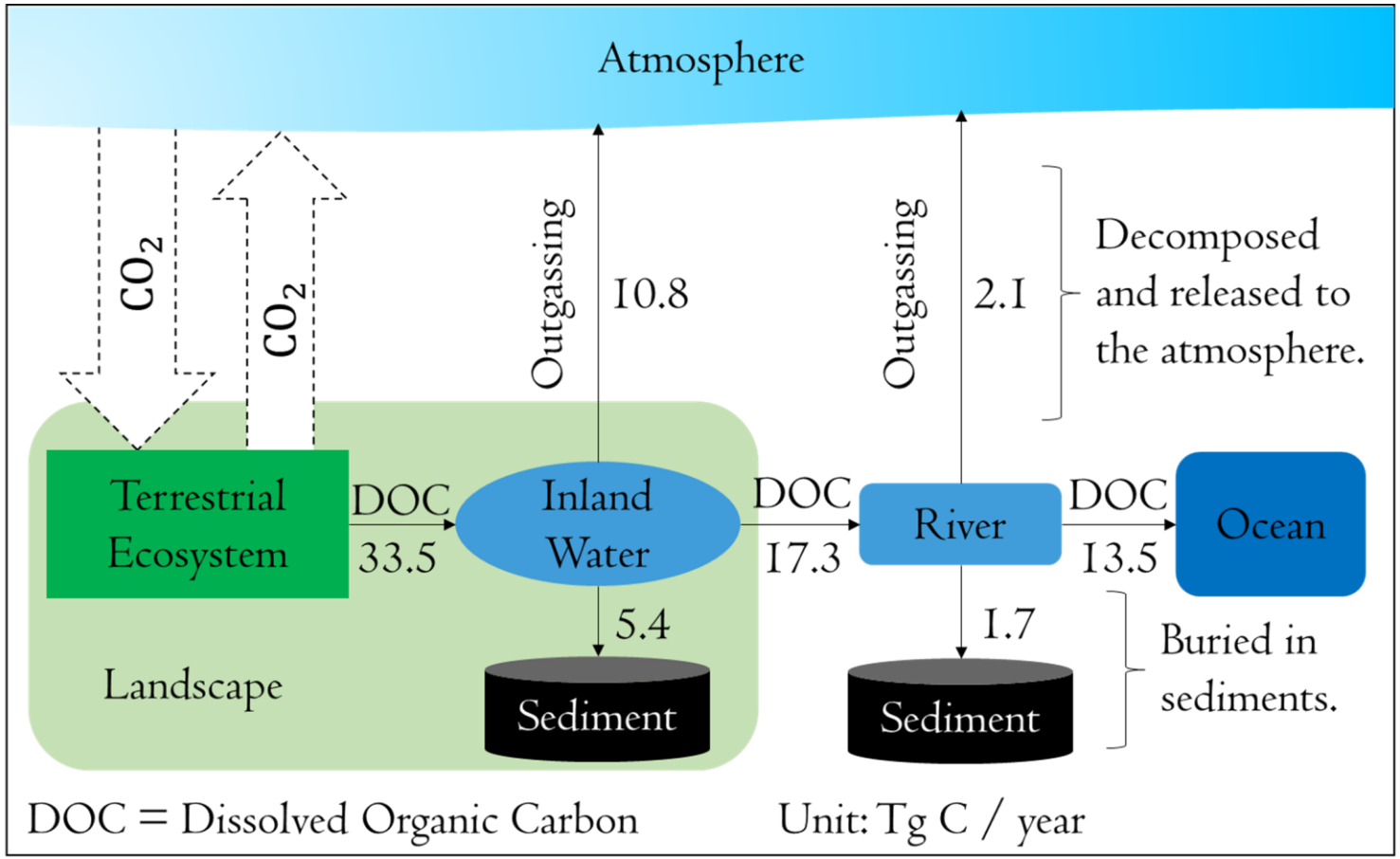
Results and Conclusions



The estimated DOC loading from terrestrial to aquatic ecosystems to be 33.5 TgC per year in the conterminous United States.

Finally, 13.5 TgC DOC is delivered to the coastal ocean in riverine export.

Conclusions

Precipitation is the dominant driver for interannual DOC dynamics.

The longer-term trend of DOC flux is strongly controlled by the rate of sulfur deposition.

knowledge gaps

- The effects of disturbances on DOC export.
- Model the DOC leaching from soils to inland waters.
- Model the sedimentation and decomposition in aquatic ecosystems.