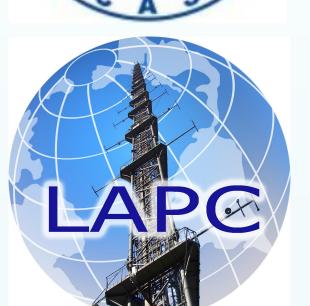
AP A S

Modification and application of

hydro-biogeochemical model (CNMM-DNDC)



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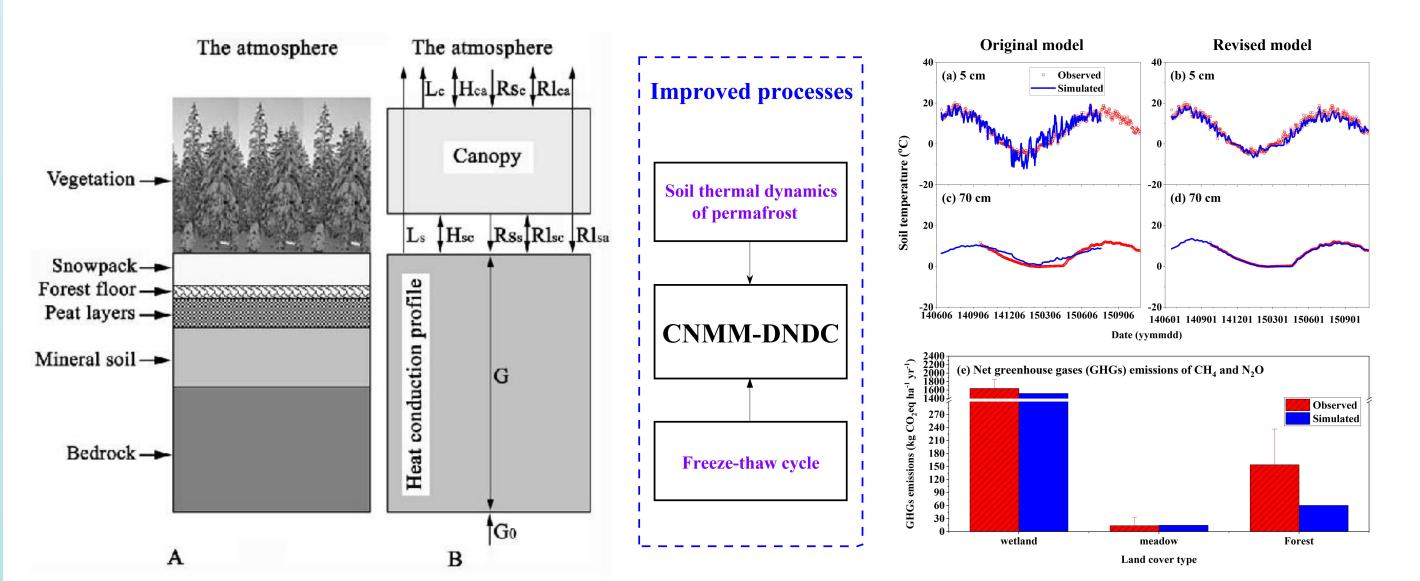
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BACKGROUND

The CNMM-DNDC, which is developed by the authors, is a three-dimension (3D), high-resolution and process-oriented terrestrial hydro-biogeochemical model that fully couples the cycling processes of carbon (C), nitrogen (N), phosphorous (P) and water in terrestrial ecosystems at site, catchment, regional, or global scales. The model can be generally applicable for long time 3D and "3H" integrative simulations of terrestrial ecosystems in different bioclimatic zones from tropical to boreal permafrost regions, wherein the "3H" is referred to high spatial, high temporal and high process resolutions. The predictable variables include at least hydraulic soil erosion, surface runoff and subsurface flow, leaching of water and C, N and P solutes, horizontal flows of dissolved and particle C, N and P substrates or matter, emissions of greenhouse gases (carbon dioxide, methane, and nitrous oxide) and gaseous N pollutants (ammonia and nitric oxide), ecosystem productivity, water evapotranspiration, and balances of energy, water, C, N and P.

MODEL MODIFICATION #1

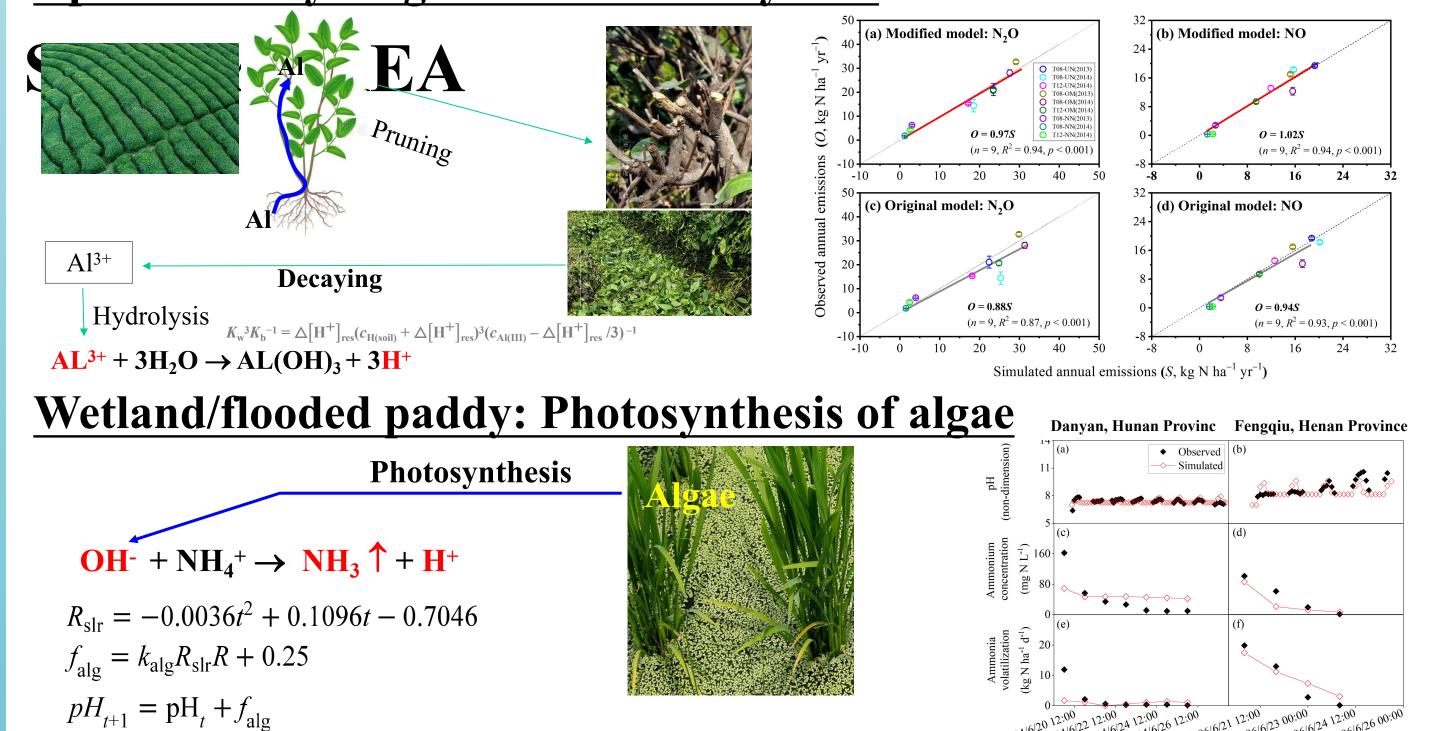
Processes of heat conduction and energy balance in CNMM-DNDC were modified by referring to the NEST model, which greatly improves performances in regions with seasonal frost or permafrost.



MODEL MODIFICATION #2

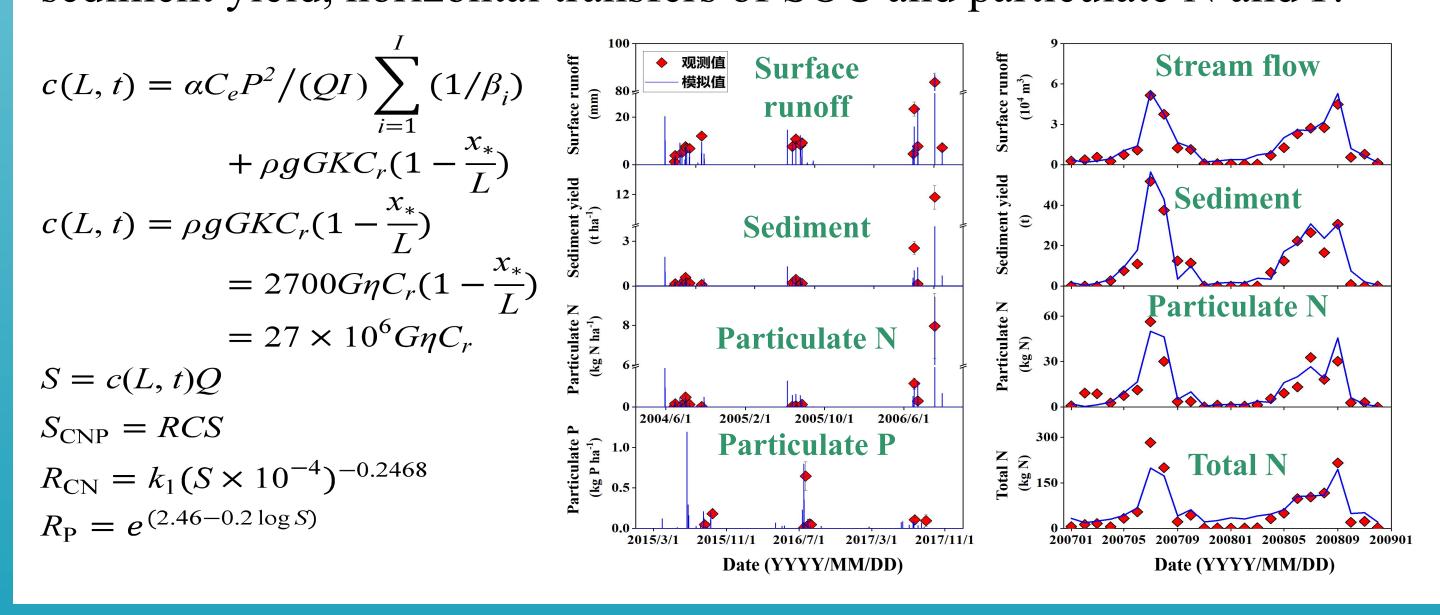
Two new mechanisms regulating soil pH were established.

Upland: Al cycling in soil-tea tree system



MODEL MODIFICATION #3

A process-oriented soil erosion model (ROSE) was introduced into the upgraded CNMM-DNDC, which enables CNMM-DNDC to simulate sediment yield, horizontal transfers of SOC and particulate N and P.



MODEL MODIFICATION #4

A new module for forest growth derived from Biome-Bio Geochemical Cycles (Biome-BGC), including photosynthesis, litter decomposition, allocation, respiration and mortality, was introduced into the CNMM-DNDC to improve the model performance in simulating the plant growth of forest ecosystem, as well as the related water and carbon fluxes.

The gross primary productivity (GPP)

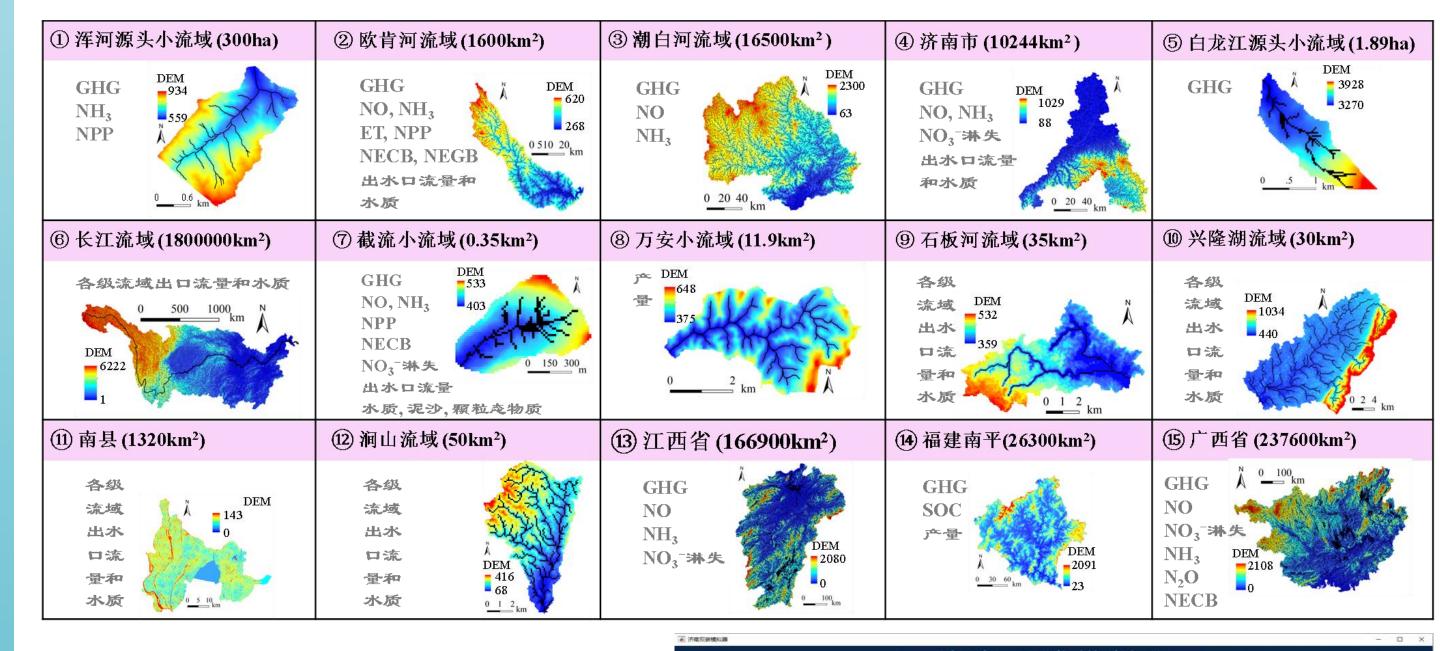
$$A_{(\text{v or j})} = g_{\text{CO}_2}(C_{\text{a}} - C_{\text{i}})$$

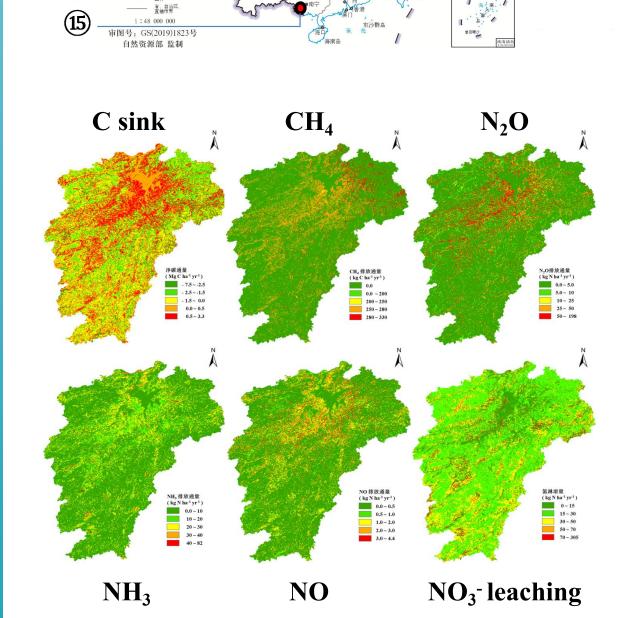
$$A_{\text{v}} = \frac{V_{\text{max}}(C_{\text{i}} - \gamma)}{C_{\text{i}} + K_{\text{c}}(1 + \frac{C_{\text{O}_2}}{K_{\text{o}}})} - \text{MR}_{\text{leaf}}$$

$$A_{\text{j}} = \frac{J(C_{\text{i}} - \gamma)}{4.5C_{\text{i}} + 10.5\gamma} - \text{MR}_{\text{leaf}}$$

MODEL APPLICATION

Till now, CNMM-DNDC have been tested or applied in environmental protection management practices in 15 watersheds or regions distributed in subtropical and temperate climate zones in China.





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Used as a tool predicting non-point water pollution at a subtropical catchment.



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