

Comparing national greenhouse gas budgets reported in UNFCCC inventories against atmospheric inversions

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'Atmospheric inversion' is the calculation of surface-toatmosphere emissions using atmospheric measurements, a gas transport model and a prior map of fluxes. They provide optimized monthly fluxes of CO₂, CH₄, N₂O. We used an ensemble of 6 models for CO₂, 22 for CH₄, and 3 for N₂O from recent synthesis of the Global Carbon Project.



https://essd.copernicus.org/preprints/essd-2021-235/essd-2021-235.pdf

We compiled and harmonized a dataset of annual national emissions for all countries from UNFCCC (annual inventories, Biennial Update Reports, National Communications).



We separated natural from anthropogenic emissions, and transformed CO_2 fluxes into terrestrial C stock changes using additional ground-based information.



For CO₂, we found a global land carbon sink of 2.5 Pg C y⁻¹ compared to only 0.3 Pg C y⁻¹ in inventories. This is explained by unmanaged lands not counted by inventories in some large forested countries, environmental factors partly counted in inventories & other uncertain fluxes like soil carbon change.

- Northern countries : larger carbon sink than inventories.
- Tropical forested countries : small sources of carbon in inversions.

Fossil CH₄ emissions



For CH_4 , we found a fair agreement between inversions and inventories for anthropogenic sources of large emitters : EU, US, China. But more fossil CH_4 emissions than reported in inventories in key oil and gas countries : Russia, Central Asia, Persian Gulf region and in Indonesia (IDN).

N₂O emissions



For N_2O , we found higher emissions in tropical countries than inventories, but significant natural emissions from unmanaged lands make the separation of anthropogenic fluxes difficult.

