An improved laser-diffraction analysis-based approach on soil aggregate stability: a new factor governing soil methane uptake

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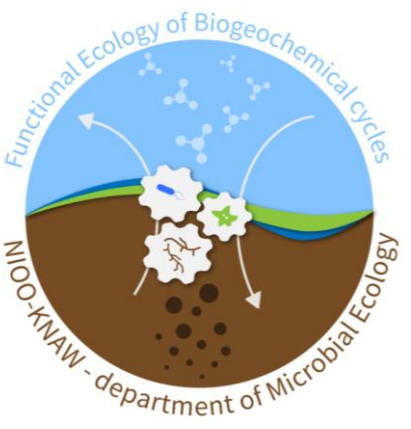
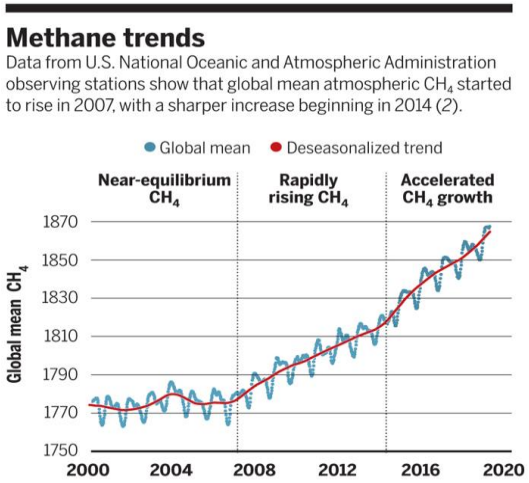
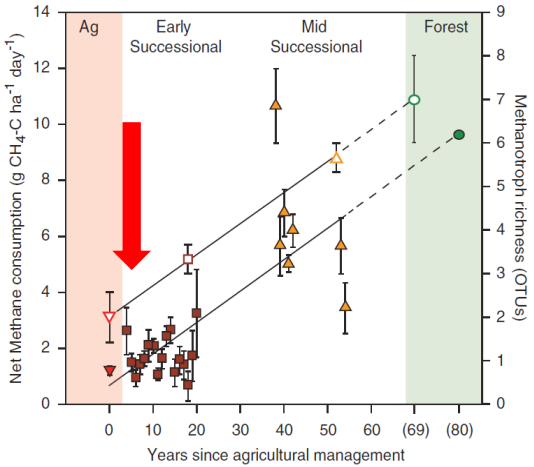
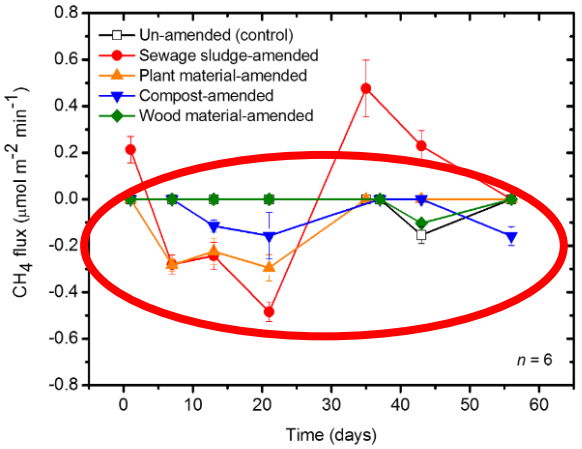


- Methane (CH_4) is the 2nd most abundant GHG with a GWP 24x-CO_2
- Soils are the only biological CH_4 sinks
- Agricultural practice reduces soil CH_4 uptake capacity substantially

→ Use of organic amendments (OA) stimulates atmospheric methane uptake







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Levine, U. *et al* (2011). *The ISME journal*, 5(10), 1683-1691
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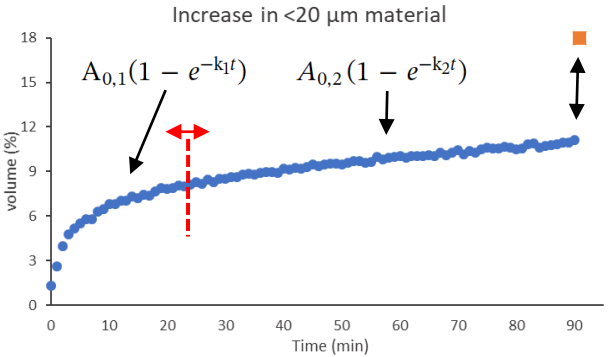
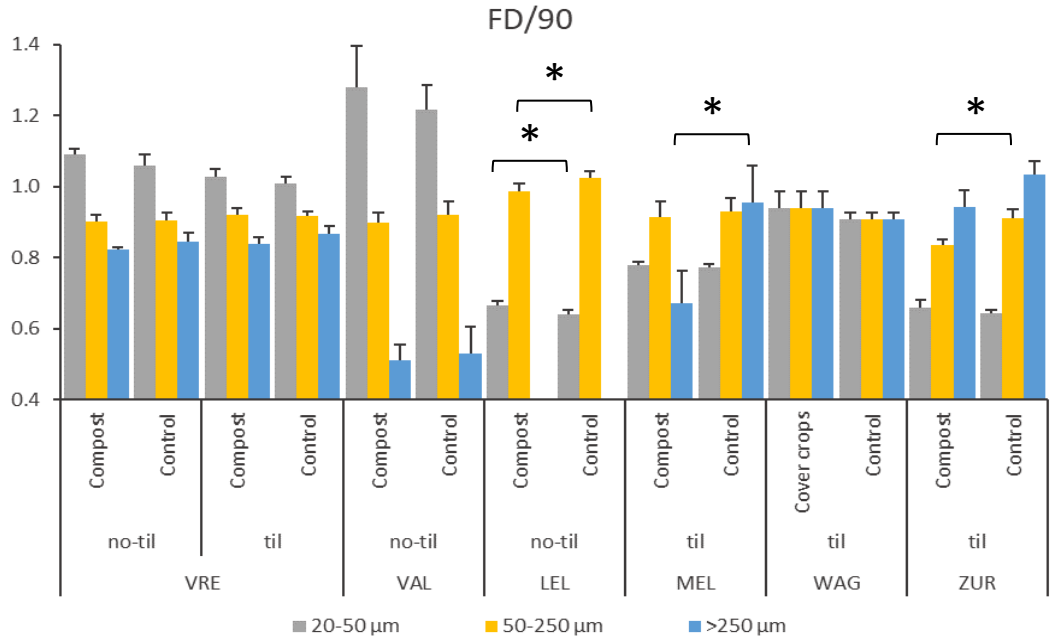
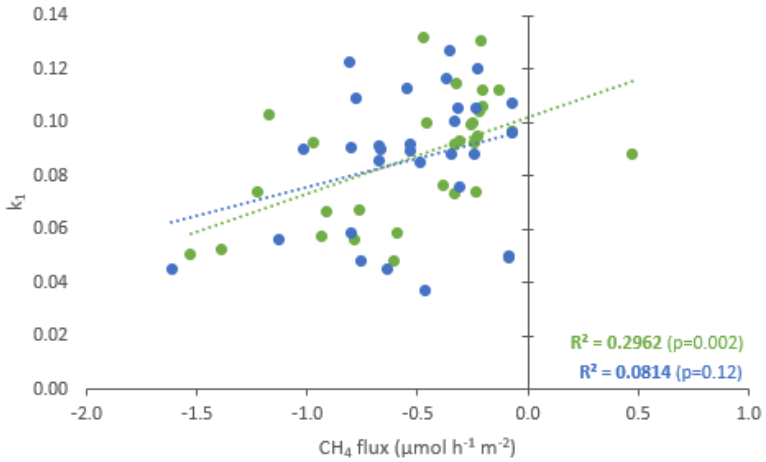
- Field study: long-term OA application
- *In situ* greenhouse gas flux measurements
- Laser diffraction analysis of aggregate stability
  - Model increase in small particles
  - Descriptive parameters for distinct populations of aggregates
    - Weak aggregates
    - Stable aggregates
    - Persisting stable aggregates

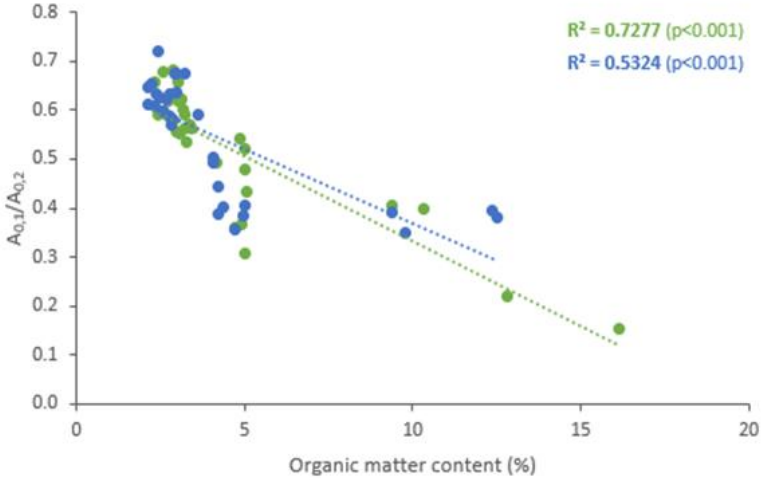


- **Organic-amended soils** have significantly **more persisting stable macro-aggregates** (<250 µm) ($p < 0.001$)



- A population of aggregates with a **low disintegration speed** (k_1) correlates significantly with a **higher soil methane uptake** ($p < 0.001$)
- Soils with a **higher organic matter content** have **more stable aggregates** versus weak aggregates ($A_{0,1}/A_{0,2}$) ($p < 0.001$)





Use of organic amendments on agricultural soils

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Enhanced SOM content

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Improved aggregate stability

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Enhanced soil CH_4 uptake

→ **Creates a basis for a new, climate smart CH_4 mitigation strategy**

→ Outlook: elucidate underlying mechanisms

Thank you for your attention

Please contact me for any questions or more information on the developed methods and results of the study!

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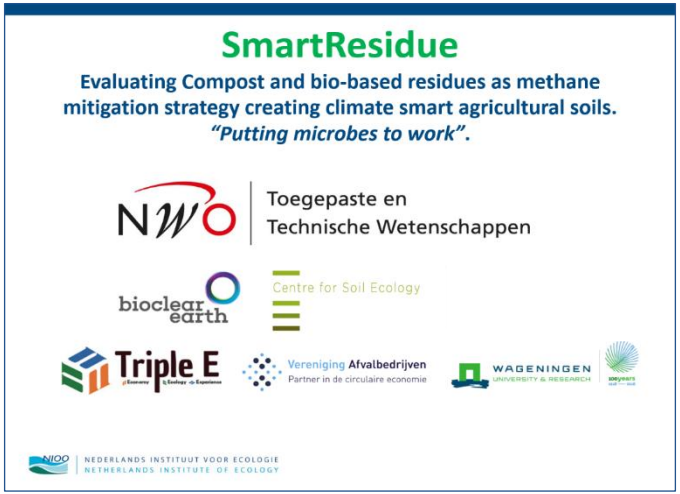

- The SmartResidue project:

SmartResidue

Evaluating Compost and bio-based residues as methane mitigation strategy creating climate smart agricultural soils.
"Putting microbes to work".

NWO | Toegepaste en Technische Wetenschappen

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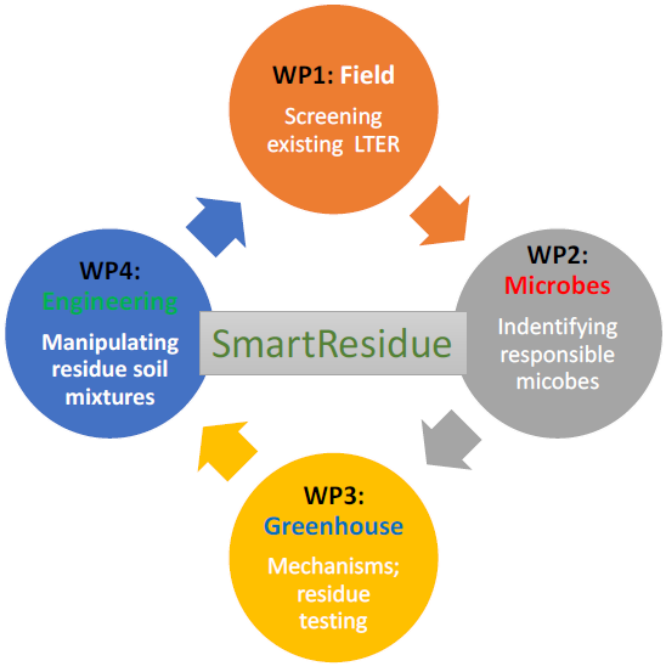
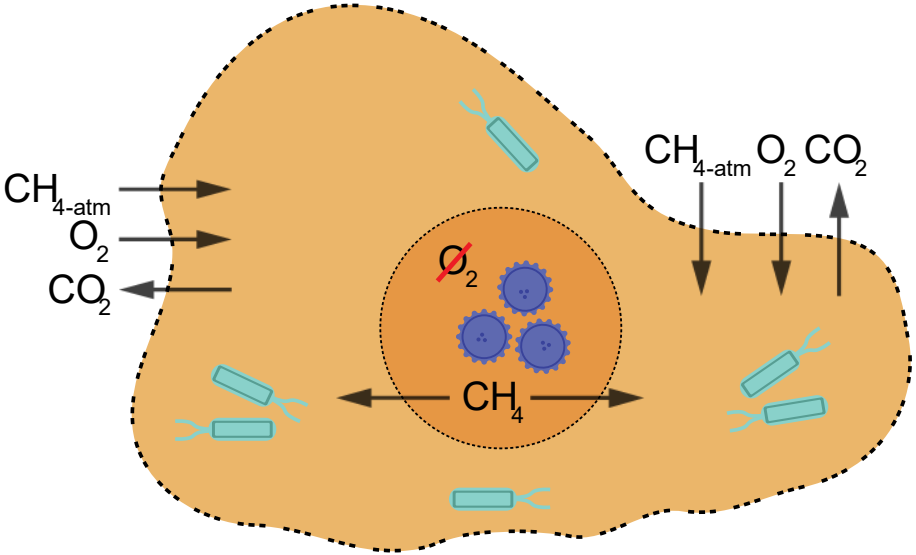
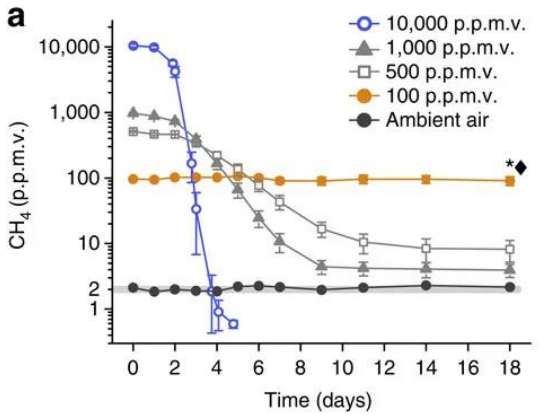


- Organic amendment addition improves aggregate stability, which enhances internally produced CH_4 in the aggregate's anaerobic core
- Internally produced CH_4 activates conventional methane oxidizing bacteria to oxidize atmospheric CH_4





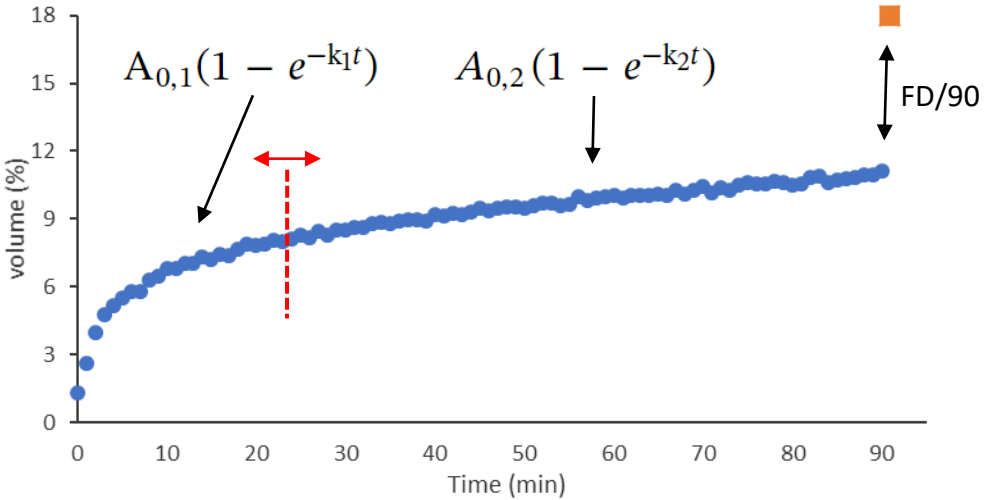
Cai, Y. *et al* (2016). *Nature communications*, 7(1), 1-10.

- Laser diffraction analysis of aggregate stability
  - Model increase in small particles: $\% < 20\ \mu m = A_{0,1}(1 - e^{-k1t}) + A_{0,2}(1 - e^{-k2t})$
- Descriptive parameters for distinct populations of aggregates:

  Weak aggregates (WA), stable aggregates (SA), persisting stable aggregates (PSA)

Parameters:

k_1, k_2	disintegration-speed WA & SA
$A_{0,1}/A_{0,2}$	ratio WA/SA
FD/90	presence of PSA



Kasmerchak, C. *et al* (2019). *Geoderma*, 338, 430-444.