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Multi-Scale Spatialisation of N₂O emissions by soils and their mitigation potential in the Bourgogne Franche-Comté Région

Projet NatAdGES – WP2
<https://www6.inrae.fr/natadges>
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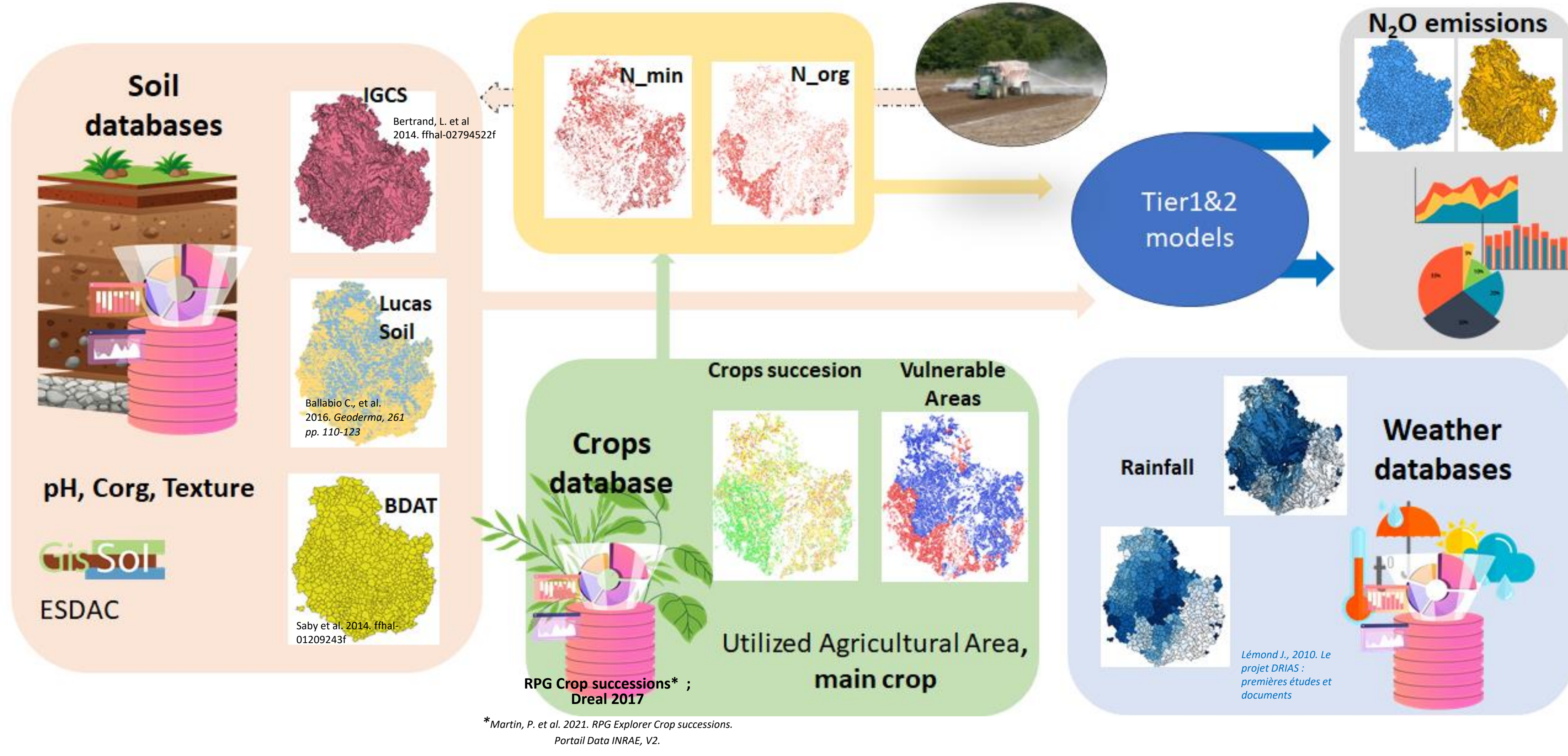
Context

- Agriculture is estimated to contribute to around 20 % of national greenhouse gas (GHG) emissions through N₂O and CH₄ emissions
- N₂O is a potent GHG emitted by soils during microbial alternative respirations
- The French Low Carbon National Strategy (NSLC) expects agriculture to have reduced its emission by 46 % in 2050
- The « Méthodologie du Label Bas Carbone en Grandes Cultures (MLBCGC) » mentions Climatic Liming as a lever for N₂O mitigation by agriculture
- Climatic Liming means the application of lime materials to soil at a rate allowing to reach pH = 6,8 in order to favor N₂O reduction (Hénault *et al.*, 2019)

Objectives

- ⇒ Spatialized quantification of Soil N₂O emissions and their Potential Abatement in the BFC Region by Climatic Liming

Materials and Methods



Used Tier 1&2 Models

Tier 1 : Basic model proposed by the IPCC (Hergoualc'h *et al.* 2019) based on emission coefficients related to N availability in soil

MLBCGC : Extension of the Tier 1 method (Soenen *et al.*, 2006)

$$N_{emission} = C_{liming}[(N_{min} \times EF_{min}) + ((N_{org} + N_{residu} + N_{min_{cratse}}) \times EF_{org})]$$

$$C_{liming_{L,k}} = 1 - \frac{\min(pH_{final} - pH_{initial}; 0.4)}{0.4}$$

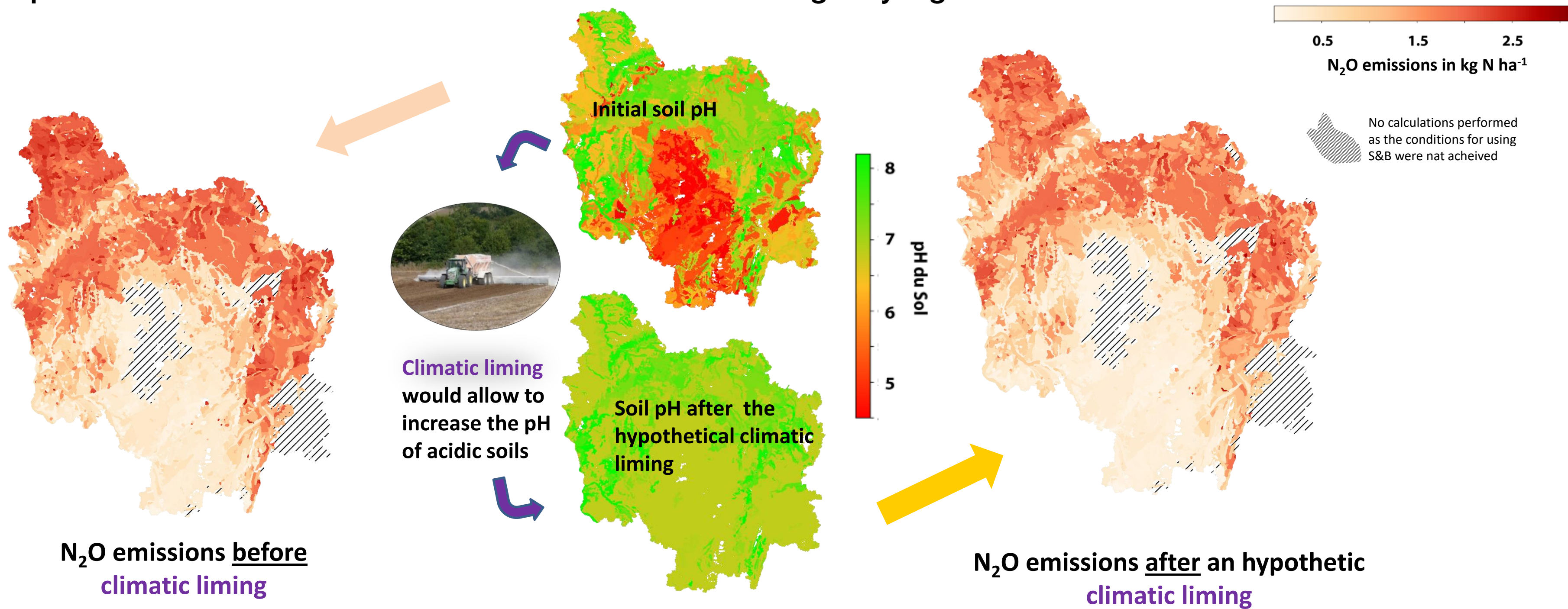
EFx : Emission Coefficients provided by the IPCC – Ny (Nitrogen in soils) – C_{liming} : N₂O abatement coefficient

S&B : Relation defined by a meta-analysis of international data (Stehfest and Bouwman, 2006)

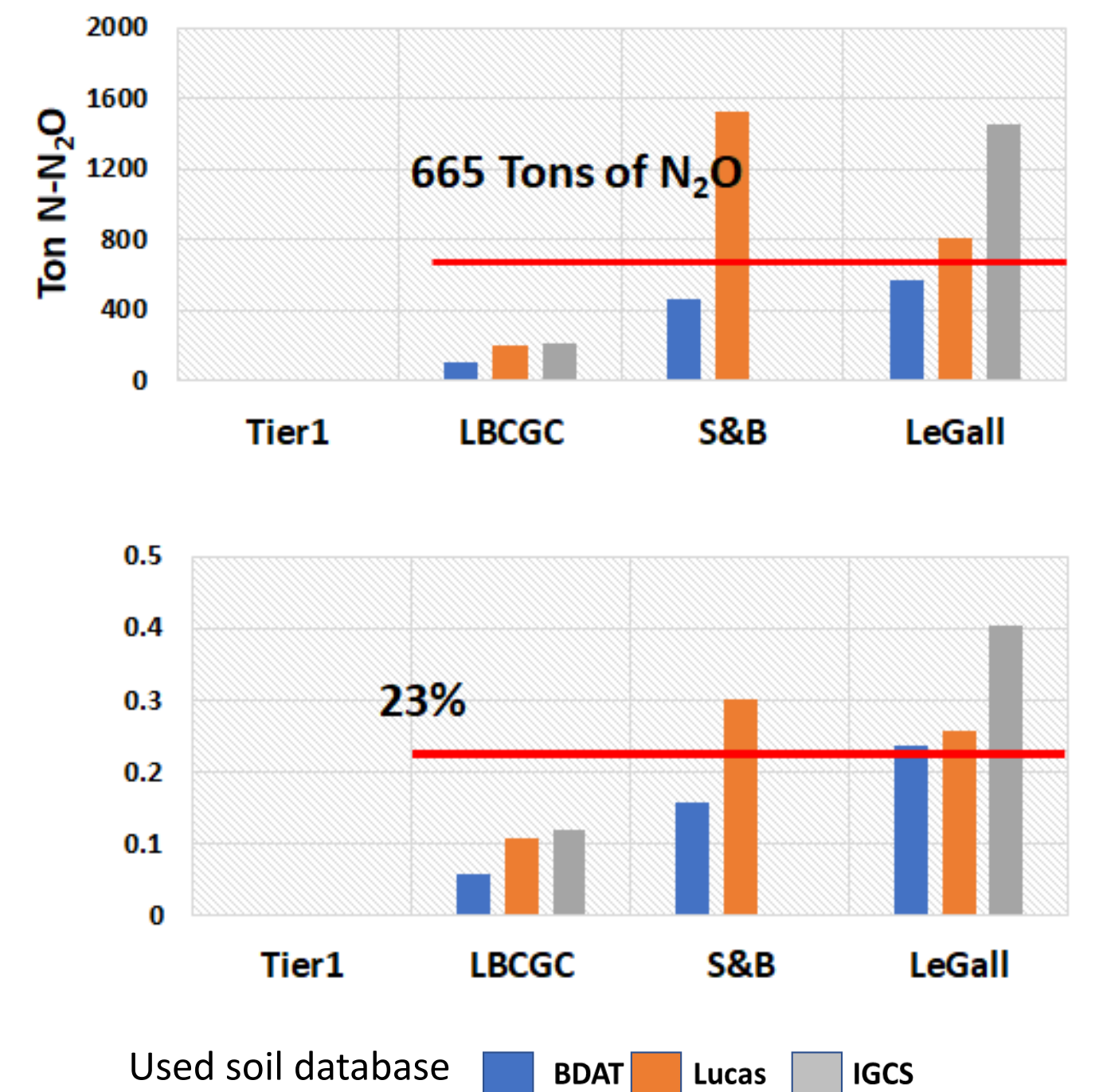
Le Gall : Relation defined by an analysis of French data (Le Gall *et al.*, 2016)

Results

Example of Calculations with IGCS database and MLBCGC in Burgundy region



Estimation of potential abatement



All methods, defined independently, predict an abatement of soil N₂O emission of around 20 % by the management of soil pH

Discussion

Strengths		Weaknesses	
<ul style="list-style-type: none"> • Estimations of abatement are consistent (whatever the methodology used) • Sensitive analysis to methods and databases • Quantitative approach • Spatialised multi-scale approach with an aggregat communal resolution 	<ul style="list-style-type: none"> • Data available on https://doi.org/10.57745/94WYGJ • Possible analysis in view of the NSLC objectives • Transferable approach to other regions and other levers • Evolutionary approach (calculation functions) 	<ul style="list-style-type: none"> • Conditions to define Tier 2 functions • Heavy handling of databases and constraints on their confidentiality • Soil databases temporality • To be completed by taking into account possible CO₂ emissions related to the practice of liming 	
Opportunities		Threats	
<ul style="list-style-type: none"> • Low Carbon Methodology in field crops • The Opteer platform that allows results dissemination via regional systems for observation, analysis and territorial forecasting of the ecological transition 		<ul style="list-style-type: none"> • Financial support deadline / sustainability of the approach 	

Short-term perspectives :

- To publish « une fiche territoriale » on the Opteer platform*



* "The OPTEEER platform is dedicated to energy, air and climate territorial Observation and Prospective at the Regional scale". <https://www.opteer.org/>