Institute of Agricultural Sciences in the Tropics (Hans-Ruthenberg-Institute)

Zonal and Seasonal Methane Emissions from Rice Production in the Vietnamese Mekong Delta

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Introduction

55% of Vietnamese rice are produced in the Mekong River Delta (MRD) (Fig.1). Rice fields are known to emit large quantities of methane (CH_4), but emissions strongly vary between seasons and locations within the MRD.

Rice in MRD is produced in three seasons, early year, mid-year and late year season, and in three zones, saline, alluvial/ acid sulfate, and flood-prone zone (Figure 2).

At national scale, CH_4 emissions are estimated based on the IPCC guidelines provide default emission factors (EFs) at sub-continental scale without taking into account such seasonal and zonal effects.

This study investigates the effects of season and zone on EFs in the MRD.

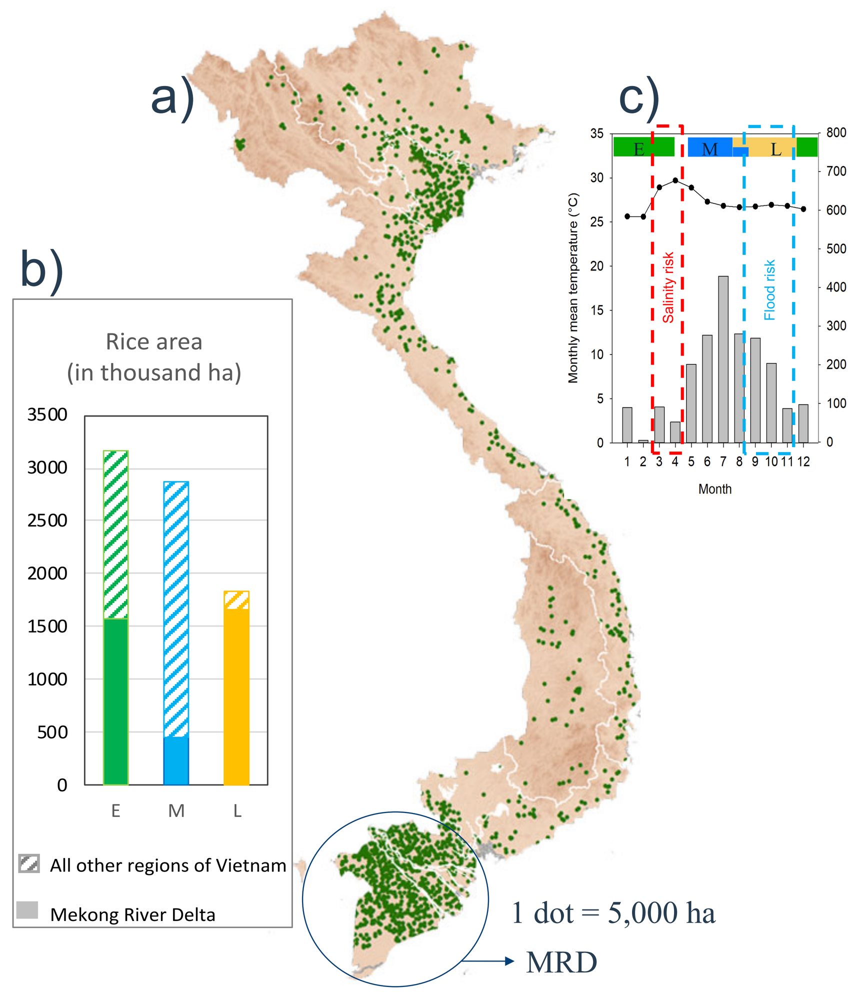


Figure 1. a) Distribution of rice in Vietnam. b) Total rice area (E-green = early season, M-blue = middle season, L-gold = late season) c) Climate and cropping calendar in the MRD.

Conclusions

- CH_4 emissions are mainly determined by cropping seasons and to a lesser extent by hydrological zones.
- In turn, using season-based EFs is preferable to zone-based EFs
- EFs of CH_4 in MRD rice production are in range 31 – 908 kgCH_4 ha^{-1} season^{-1}
- These data clearly show that CH_4 emissions in MRD rice production are well above the default IPCC value given for Southeast Asian rice production.

Results

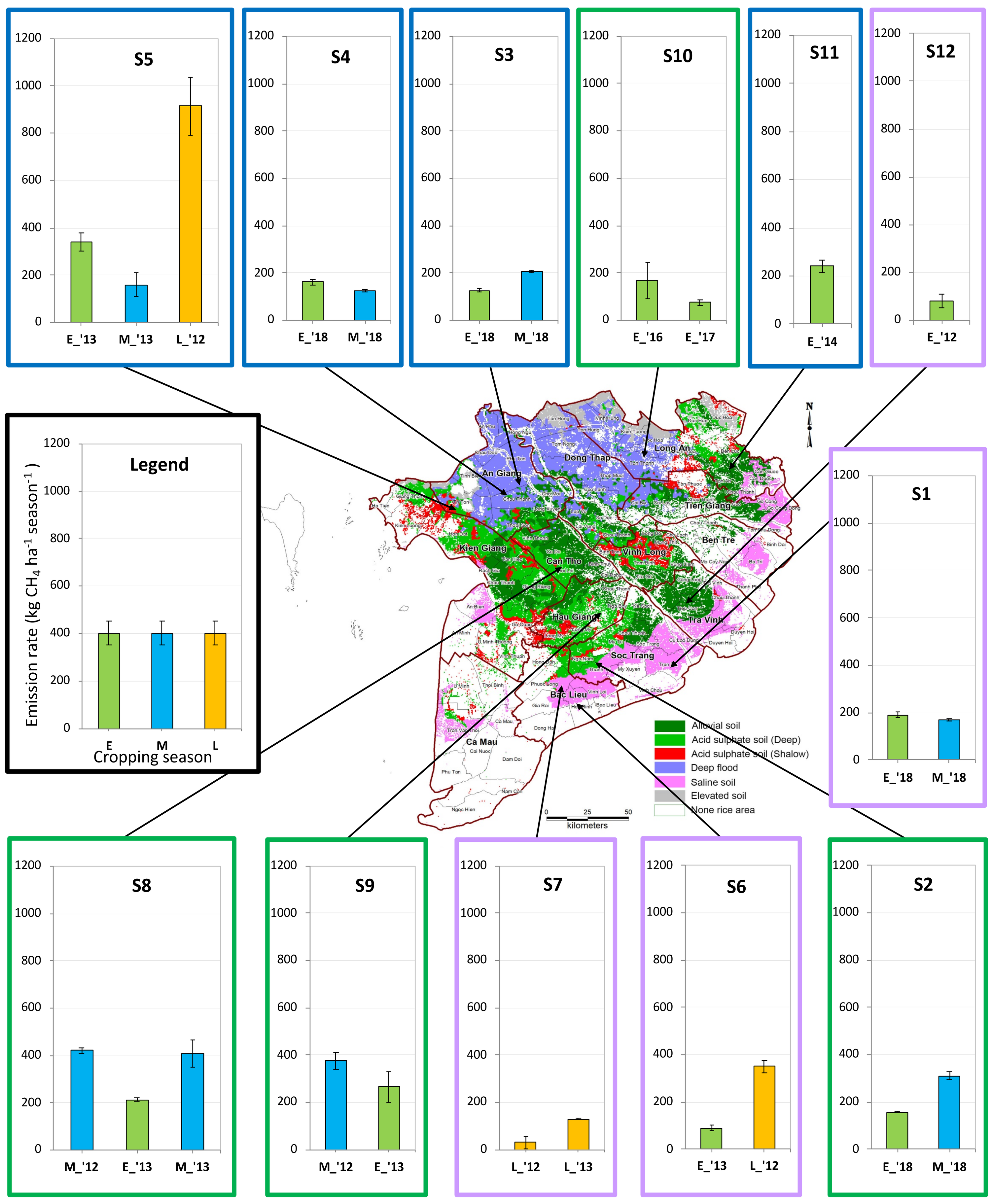


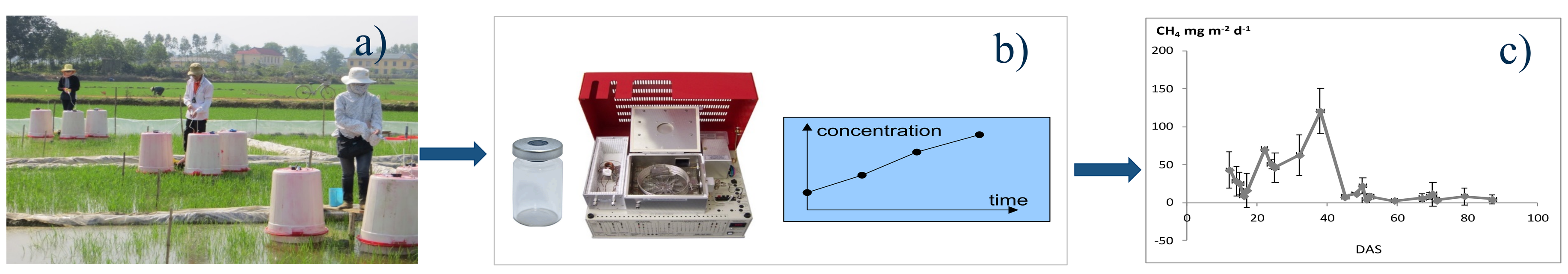
Figure 2. Seasonal CH_4 emission rates from rice fields in the MRD. Frame color indicates alluvial (green), deep flood (blue) and saline (magenta) zones; Seasonal EFs (early year (E), mid-year (M) and late-year (L)) are color coded as in Fig. 1. Error bars = standard error; n = 3.

Table 1. Seasonal CH_4 emission factors; average (± SD), max and min CH_4 emission rates; No. = numbers of seasons measured. Values are aggregated across all hydrological zones.

		Seasonal CH_4 emissions (kg CH_4 ha^{-1} season^{-1})			
Season	No	Avg ± std	p *	Max	Min
Early year season	12	174 ± 82	0.03	245	80
Mid- year season	8	277 ± 116		417	122
Late year season	4	356 ± 481	nd	908	31

* The statistical significance value (p) at the confidence of 95% determined by one-way ANOVA. ($p \leq 0.05$: average emission factor of the two seasons are statistically significant different).

Notes on Materials and Methods



GHG measurement approach – Closed chambers a) Field sampling, b) Lab analysis, c) Daily emission

A data base derived from field measurements conducted at 12 sites with 24 cropping seasons using the closed chamber approach for field sampling in combination with laboratory analysis of CH_4 concentrations and standardized crop management. The field design consistently encompassed three replicates with IPCC baseline management while sampling was done in weekly intervals. The gas fluxes were calculated using the equation given by Minamikawa (2015). Comparison of average CH_4 emission rates among seasons and hydrological zones was performed using one-way analysis of variance (ANOVA) in SPSS v.20.