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Introduction

- In Mediterranean agroecosystems, different land-use types are randomly distributed in the territory.



- Ecosystem C and N dynamics vary among land-use types resulting in different soil greenhouse gas (GHG) fluxes.
- The objective of this study was to quantify soil GHG fluxes in four different land-use types in a typical Mediterranean dryland agroecosystem.

Materials and methods

Location: Senés, Huesca (NE Spain)

Land-use types:

- 8-yr old set-aside field with half surface cultivated (SC) and half undisturbed (SU)
- 60-yr old pine forest (FR)
- No-tilled barley monoculture (NT)

Measurements (every 20 days from December 2011 to July 2012):

- Soil GHG fluxes (carbon dioxide, CO₂; methane, CH₄; nitrous oxide, N₂O)
- Soil temperature (5 cm depth)
- Soil water content (0-5 cm depth)
- Soil mineral N

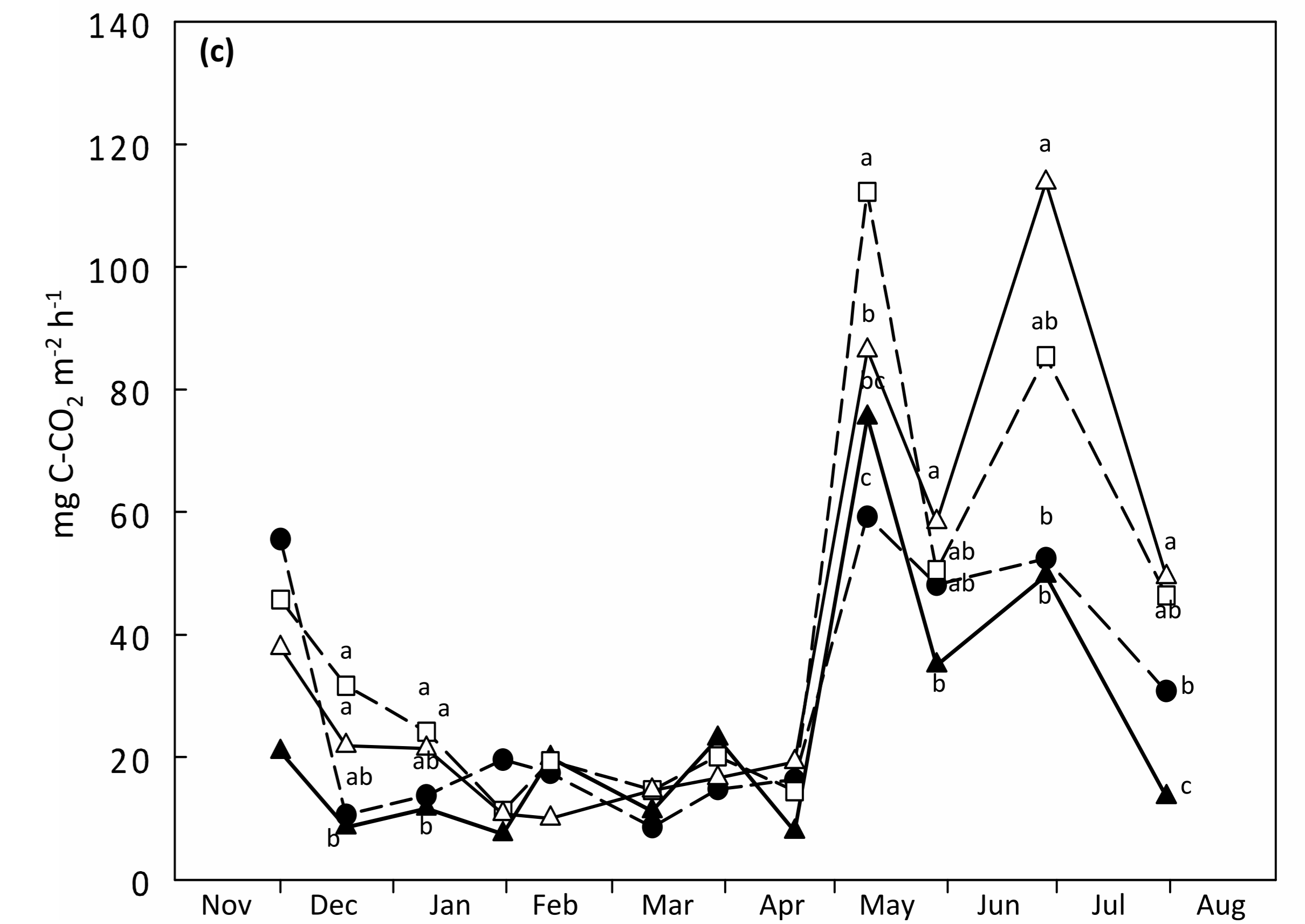
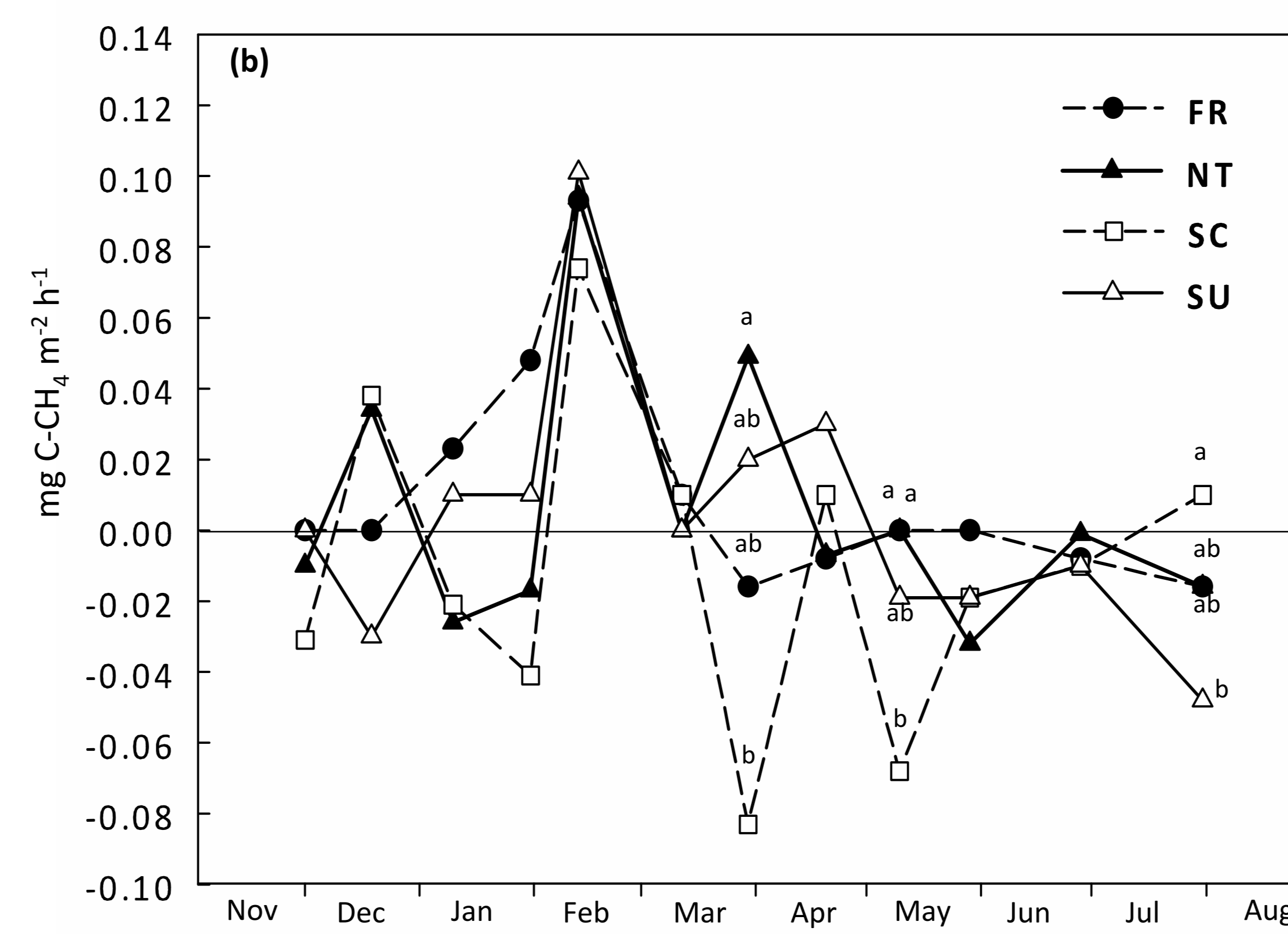
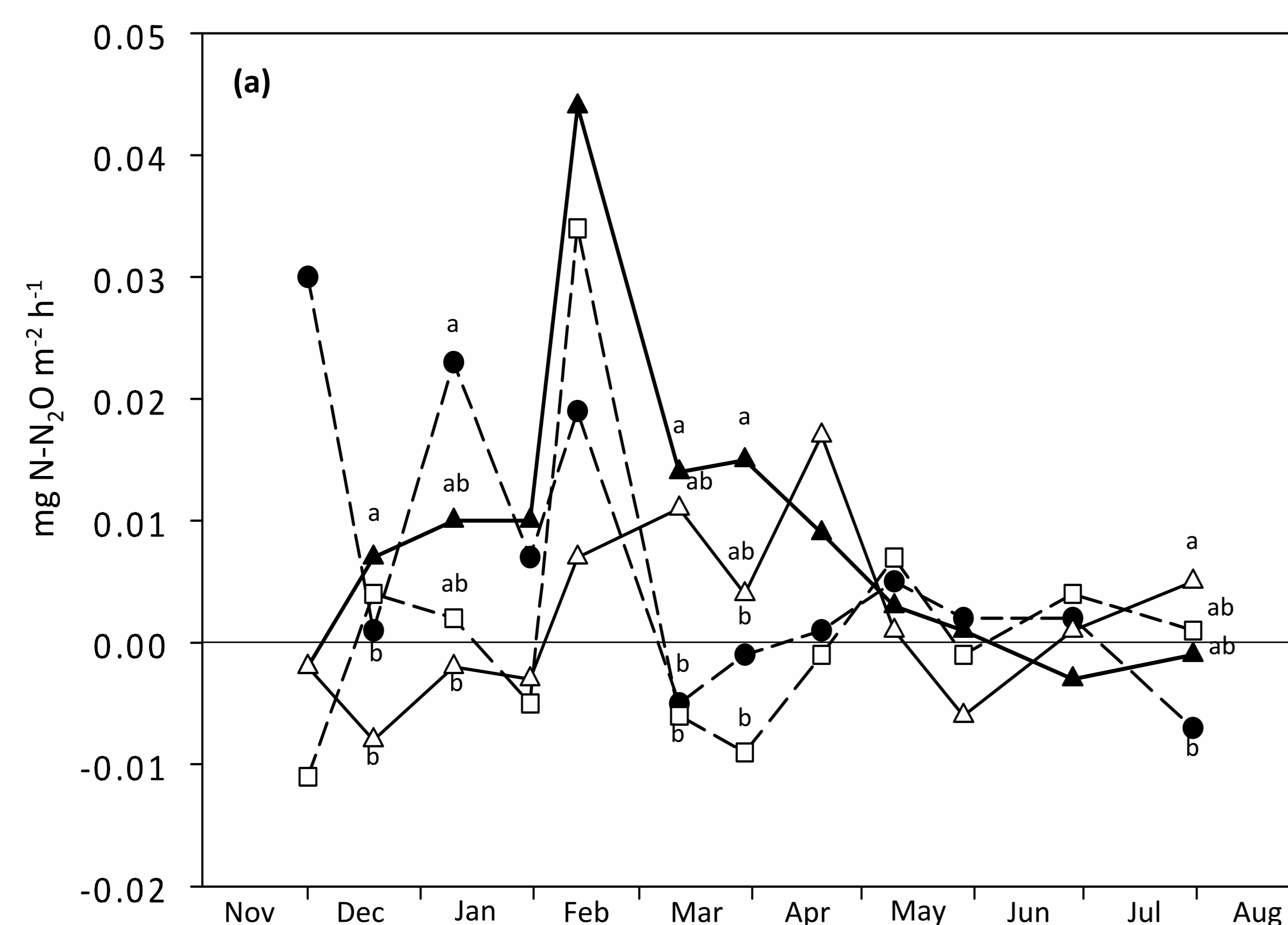


Fig. 1. (a) Soil nitrous oxide (N₂O); (b) methane (CH₄); and (c) carbon dioxide (CO₂) emissions under different land-use types (FR, forest; NT, no-tilled barley monoculture; SC, cultivated set-aside; SU, undisturbed set-aside) during the December 2011-July 2012 period. Within the same date, different lowercase letters indicate significant differences among land-use types at $P < 0.05$.

Results and conclusion

Table 1. Average soil nitrous oxide (N₂O; mg N-N₂O m⁻² h⁻¹); methane (CH₄; mg C-CH₄ m⁻² h⁻¹); and carbon dioxide (CO₂; mg C-CO₂ m⁻² h⁻¹) emissions under different land-use types (FR, forest; NT, no-tilled barley monoculture; SC, cultivated set-aside; SU, undisturbed set-aside) during the December 2011-July 2012 period. Within the same greenhouse gas, different lowercase letters indicate significant differences among land-use types at $P < 0.05$.

Greenhouse gas	FR	NT	SC	SU
N ₂ O	0.0061ab	0.0087a	0.0002b	0.0018b
CH ₄	0.0103a	0.0046ab	-0.0147b	0.0035ab
CO ₂	30.33b	23.77c	40.52a	38.35a

Acknowledgments

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- In the overall study period (December 2011-July 2012), the barley monoculture (NT) showed both the highest soil N₂O emissions and the lowest CO₂ emissions (Table 1).
- At the same time, the forest (FR) showed high mean soil N₂O and CO₂ emissions. The highest mean soil CO₂ emissions were found in both set-aside fields (SC and SU, cultivated and undisturbed set-aside fields, respectively). Furthermore, the SC and SU land-uses showed the lowest N₂O emissions (Table 1).
- Differences in soil mineral N determined differences in soil N₂O emissions among land-uses. Thus, NT had eight- and three-fold higher soil mineral N than FR and SU and SC, respectively (data not shown).
- The four land-use types showed peaks of soil N₂O and CH₄ fluxes in February 2012 (Fig. 1a and 1b) due to freezing-thawing processes occurred during this time of the year.
- Soil CO₂ emissions were low during winter and increased in spring (Fig. 1c). The increase in soil temperature in spring favored both autotrophic and heterotrophic respiration resulting in an increase in soil respiration in all four land-use types.
- In Mediterranean agroecosystems, land-use influenced soil GHG fluxes. Therefore, to evaluate the contribution of Mediterranean areas to global warming it is needed an approach that integrates the GHG fluxes from the different land-use types present in these areas.