Climate impacts due to albedo change of grassland through grazing and mowing practices in various pedoclimatic situations

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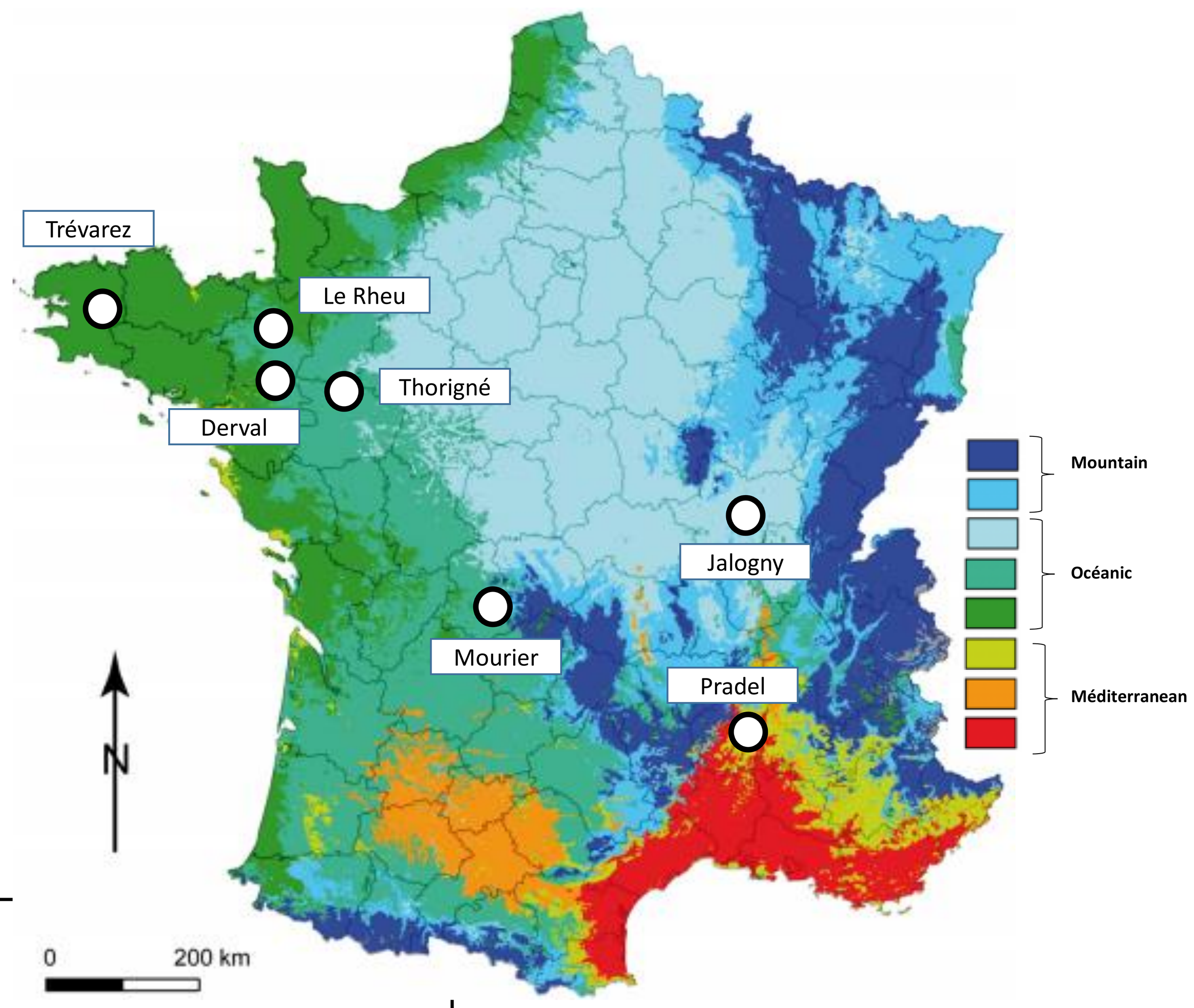
Ruminant farming impacts climate change (CC) because of land use and greenhouse gases (GHG) emissions.

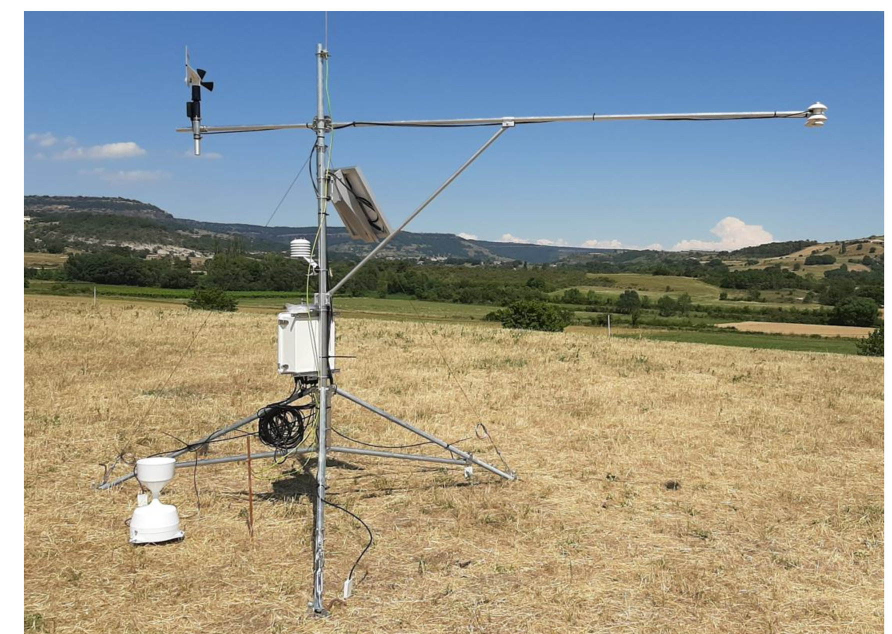
Grasslands management also affects the climate by changing land surface albedo (α).

Adapted grassland management could be a lever for CC mitigation through increase in α as well as through soil carbon storage.

➔How mowing and grazing practices influence grassland albedo ?

Grassland albedo measurement at 7 experimental sites in France





Materials and methods

- continuous surface albedo (α) measurement at 7 French experimental farms and contrasted grassland management (grazing, mowing) and pedoclimates
- monitoring: temperature, hygrometry, soil moisture, albedo

Analyse of the surface α dynamics:

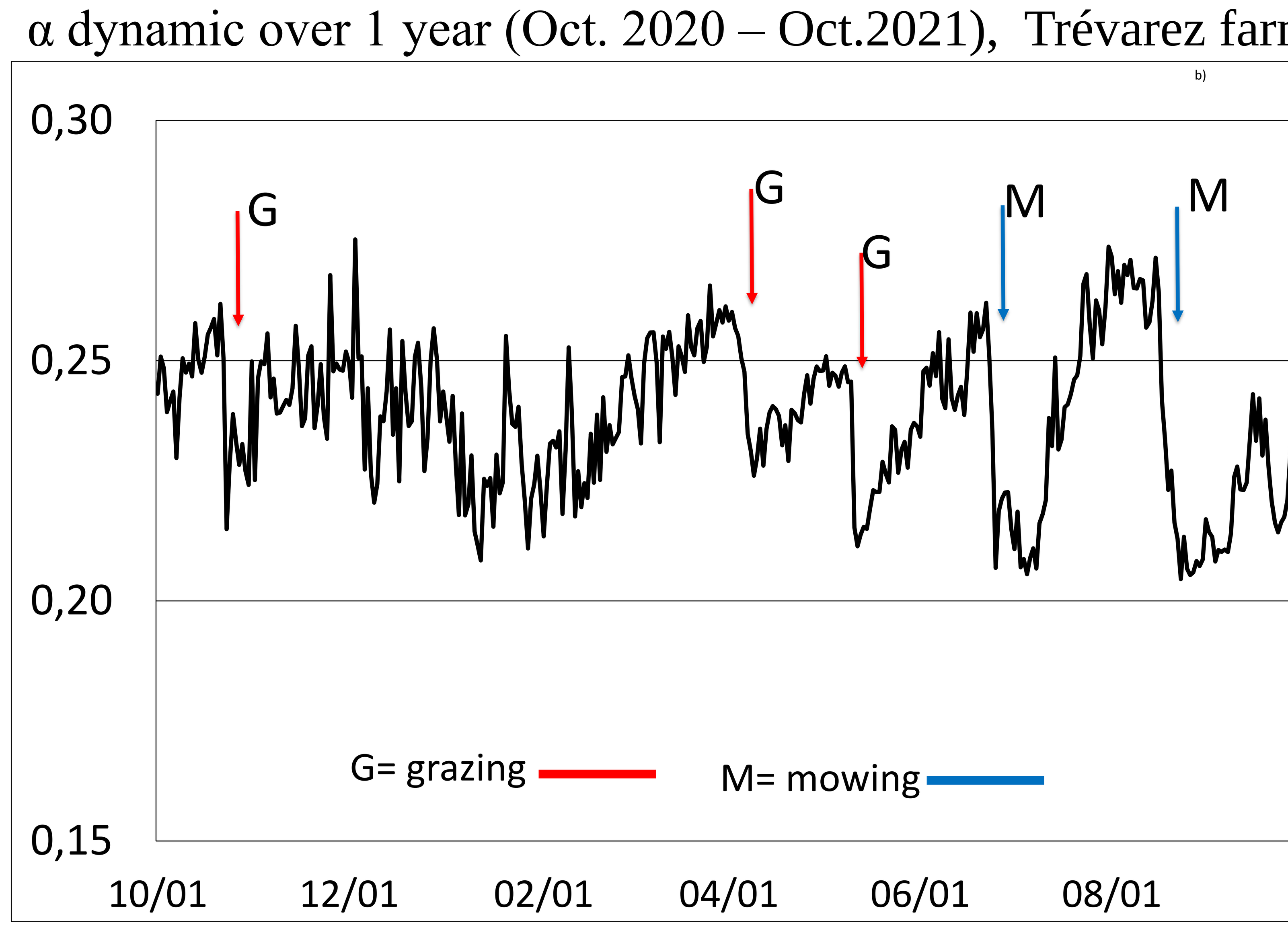
- mowing, grazing dates and soil wetting events are collected.
-α change (Δ_α) after precipitations or management events

Calculation of the Radiative Forcing (RF)

The RF was calculated on a daily time step, following Ceschia et al. 2017, considering bare soil albedo as a reference and daily values of grassland's albedo, incoming solar radiation and atmospheric transmittance. Then daily values were averaged annualy.

α change (Δ_α) following events is calculated as the difference between a reference status (α_{Ref}, i.e. α before the event) and the mean α change (α_{mean}) measured during the whole period (p) following the event , until α returns to $\pm\alpha_{Ref}$ value or, if mowing or grazing occurred before the end of the expected α recovery

α dynamic over 1 year (Oct. 2020 – Oct.2021), Trévarez farm.



Results: grassland α decrease after an event

➔grazing: - 4% for 15 (+/- 9) days, depending on stocking rate
➔rain = -7% for 10 (+/- 8) days after a rainless period
➔mowing = -14% for 31 days on Trevarez site

➔ annual grassland radiative forcing was negative (climatic "cooling" effect) on all sites compared to bare soil (ranging from -7.3 to -10.2 W/m²)

➔grazing, mowing could reduce this cooling effect (new data will allow us to compare those practices)

Grazing and rain effects on surface albedo in 7 french grassland sites.

Experimental farm	Trévarez	Derval	Rheu*	Thorigné	Mourier	Jalogny	Pradel
Mean α effect ± std	0.241 ±0.03	0.236 ±0.05	0.215 ±0.01	0.223 ±0.07	0.241 ±0.06	0.216 ±0.04	0.225 ±0.06
Grazing (n) / duration (d)	(5) / 3.8	(9) / 5.9	(6) /6.7	(5) /6	(5) / 4.4	(4) / 15	(4) / 4.8
Stocking rate LU/ha/day	43.1	31.9	36.6	8.3	23.1	3.3	3.6
Grazing pressure**	27.2	12.5	20	8.3	22.3	3.3	2.5
α cumulative decrease	-176%	-58%	-26%	-97%	-121%	-26%	-5%
α_{mean} decrease duration (d)	23.2	13.4	10.8	17.2	17.4	14.5	6
Soil wetting event (n)	No	(5)	(7)	(3)	(4)	regularly	(11)
α cumulative decrease	period	-8%	-116%	-134%	-155%	under	-280%
α_{mean} decrease duration (d)	available	6.6	7.6	11.3	10.5	water	13.9

*DOI: IE PL, INRAE, 2021. Dairy nutrition and physiology, https://doi.org/10.15454/yk9q-pf68;

** grazing pressure = [stocking rate] x [%grass in the ration]. Example: 2.5 = [3.6 LU/ha/day] x [70% grass in the ration]

Outlook:

➔radiative forcing calculation of grassland and influence of grazing & mowing
➔recommendations for grassland management
➔comparisons of the albedo effects (converted in eq-CO_2) with the carbon sequestration potential and the GHG emission of different farming systems