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## Regional variability of the climate change effect on grassland production

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### Introduction

Even if all the GCM don't give exactly the same intensity of climate change, climate change is known to be highly variable among countries and even among regions (IPCC, 2013). In France, the future of the southern part seems to be very different from this of the northern part. The aim of this paper is to show the expected yield evolutions and their differences between regions, using future climate series and crop models.

### Materials and Methods

The grassland yields were calculated inside 2 main scientific projects (ACTA\_CC (Ruget et al., 2010) and Climator (Brisson et al., 2010)), using the outputs of the one circulation model, ARPEGE from Météo-France, 2 grassland models (STICS and Pasim), 3 SRES scenarios (B1 and A2 in ACTA-CC, A1B in Climator), 2 time frames (N near, 2020-2050 and D distant, 2070-2100). The cutting practices are similar (4 cuts during the year), without irrigation (as currently managed in grasslands). A MFA on spatial data was done on the meteorological present (1980-2006) data for 235 fictive stations (Ruget et al., 2010), in order to reach a climate description, allowing to gathering of 34 stations into 8 main climatic regions.

In the crop models, the CO<sub>2</sub> concentration affects stomatal conductance, increasing RUE and decreasing transpiration. The outputs used are the annual yield, expressed as relative variation of yield.

### Results and Discussion

Whatever the region, the yield is decreasing when not taking into account the CO<sub>2</sub> effect (Table 1), while when taking it into account, the yield increases in most of the regions, except one (in the West). The following estimations are made considering CO<sub>2</sub>.

*Table 1.* Relative variation of grassland yield as function of CO<sub>2</sub> effect (ACTA-CC, STICS, SRES A2, time frame D distant, zone names: 1 mountain fots, 3 North-East, 5 and 7 North-West, 6 Mediterranean region, 8 West).

Regions	1	3	5	6	7	8
With CO <sub>2</sub>	0.084	0.019	0.065	0.056	-0.037	-0.053
Without CO <sub>2</sub>	-0.178	-0.233	-0.227	-0.186	-0.275	-0.278

In the near future (A2N, A1BN), the yield is increasing, whatever the region (Figure 1). Between time frames, results are slightly different: in most of the stations, the yield in the distant future is decreasing when compared to the near future, except for the

Climator STICS exercise. Differences can be explained partly from the differences of climate evolution: (Climator uses A1B, less warm than A2, and increased radiation) and partly by management practices (higher fertilization in Climator).

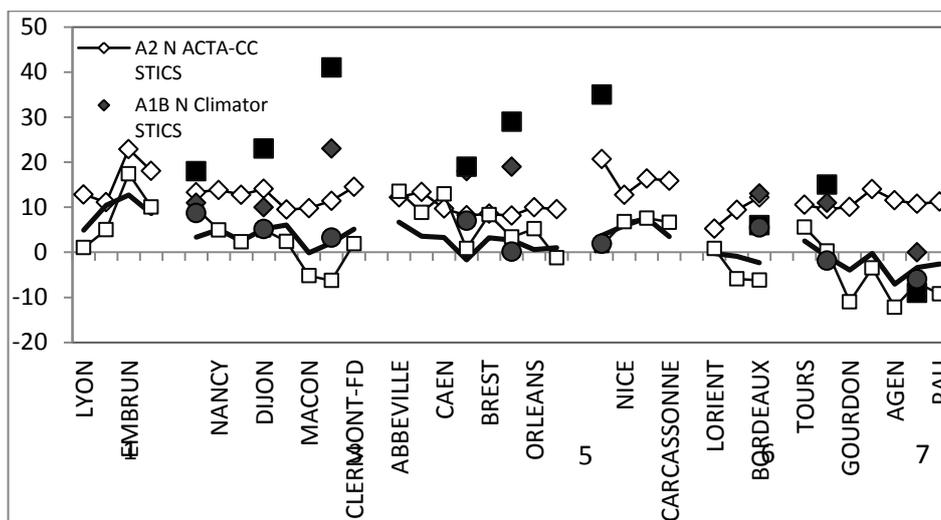


Figure 1. Variability of grassland yield among stations, gathered among climatic zones. Legend: 1 mountain foofs, 3 North-East, 5 and 7 North-West, 6 Mediterranean region, 8 West, A2, B1, A1B, 3 SRES scenarios, N near, D distant: time frame in the future, ACTA-CC/ Climator, projects, STICS/Pasim, grassland models.

### Conclusions

Even if most of the grassland yields increase in the near future for all the models, the evolution is variable among models in the distant future, except in the West region (8) where yields are decreasing in all the exercises, in the distant future. An analysis of climate (not shown here) shows that it is the region with highest temperature increase and rin decrease. A similar work is on-going on the French dairy systems in the future, using the new outputs from GCMs.

### Acknowledgements

The ACTA-CC work was founded by ACTA\_MIRES founding and the Climator project by a French ANR

### References

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