

Effect of climate change on forage production for herbivorous livestock systems in France

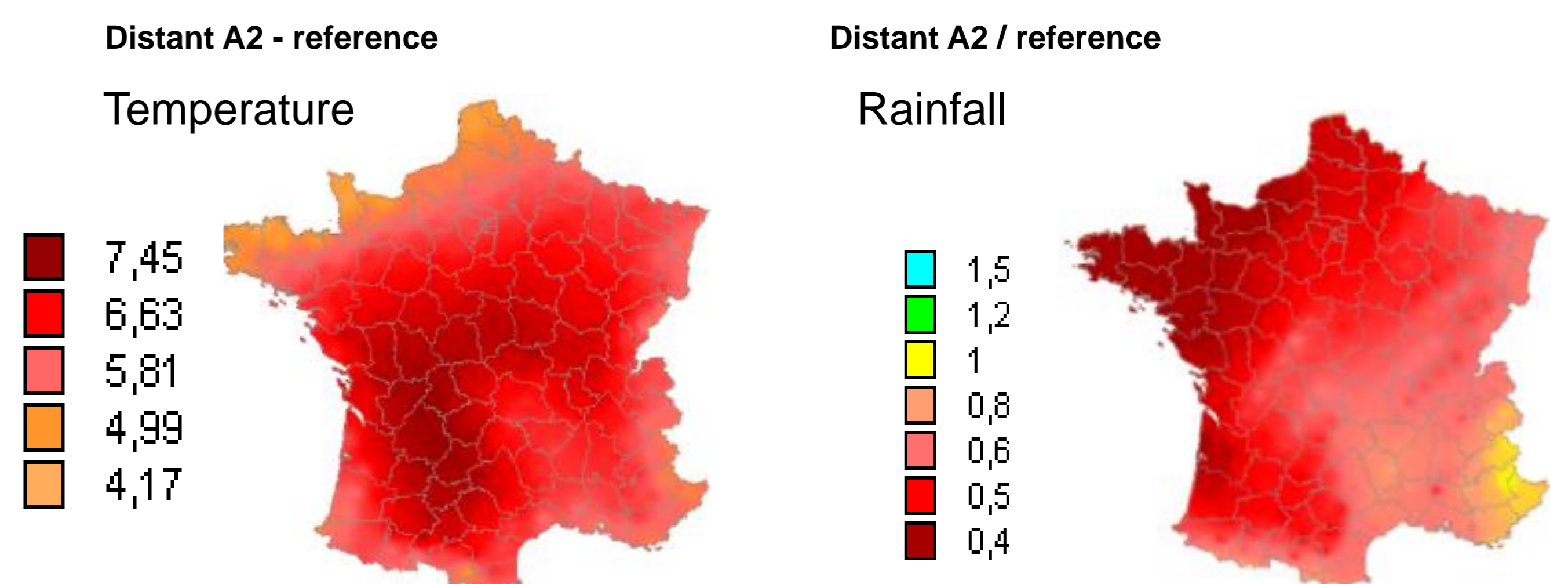
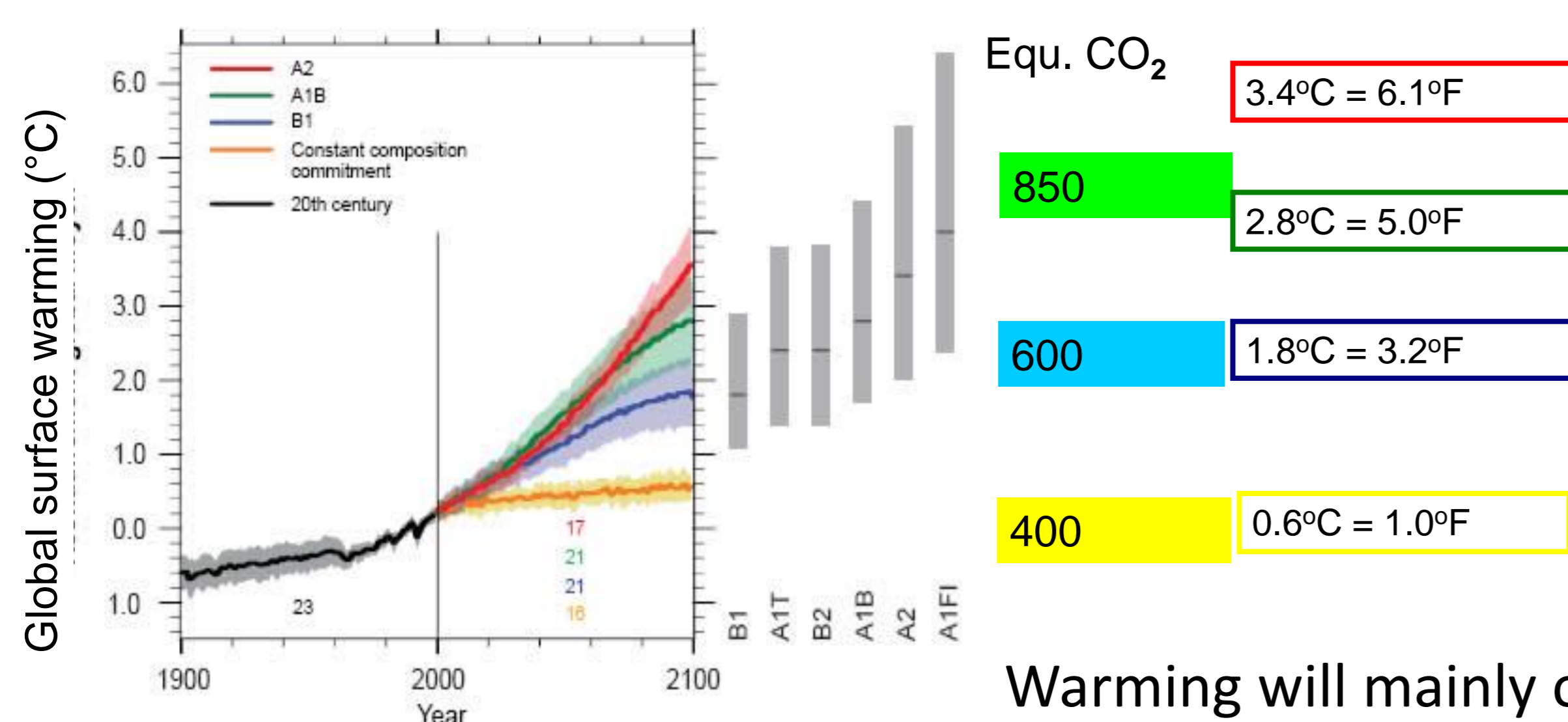
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Introduction

Global change includes climate change and the agricultural yields highly depend on climate. The study aims to know the possible change of amount and dates of production for grass and legumes (alfalfa) as consequence of climate change.

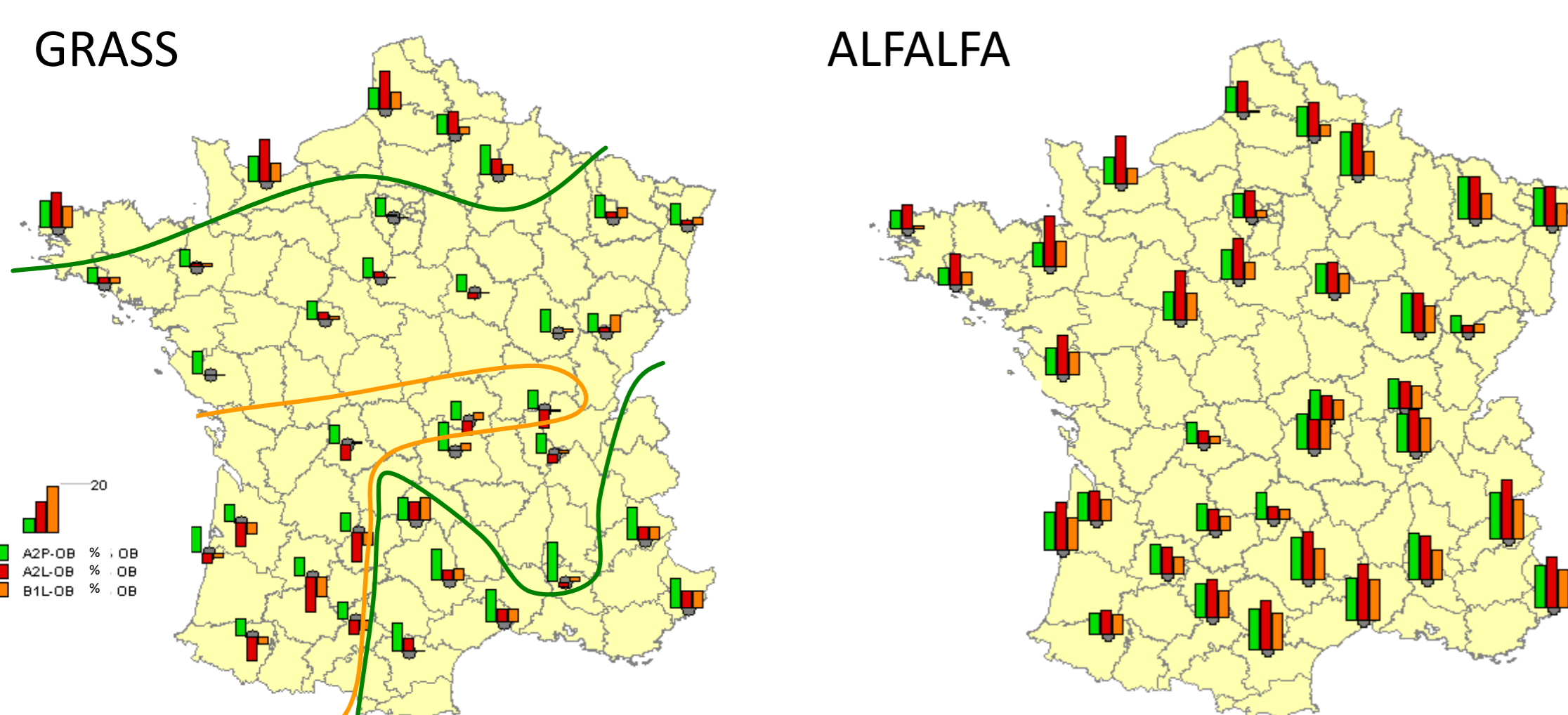
Materials & methods

We used the outputs of a GCM (general circulation model, ARPEGE, Déqué, 2007) as climate input for a crop model STICS (Brisson *et al.*, 1998), suitable for mowing crops like grasses (Ruget *et al.*, 2006) and alfalfa (Ruget *et al.*, 2008). in order to compare present production and seasonality with future production in some locations in France.



Warming will mainly occur in summer, as well as the precipitation decrease (Collective, 2009; Ruget *et al.*, 2010). Moreover, the difference between scenarios which is short in the near future become wide in the distant future. The decrease of precipitation is highly variable throughout France.

Results and discussion

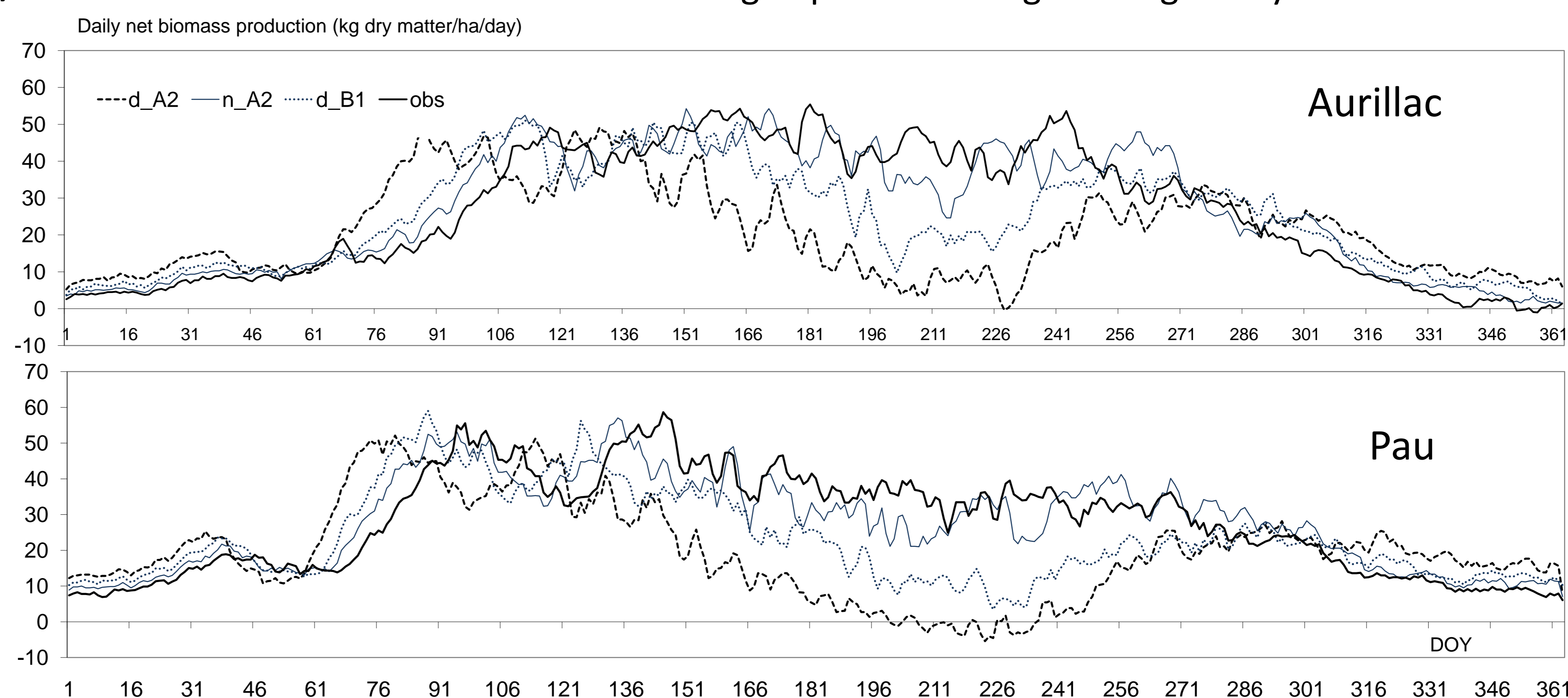


Evolution of annual yield

The spatial distribution of the changes varied between crops and period. In all the situations, production first appears to be enhanced. In the distant future, the results varied between crops: for grasses, there are four different zones, with different evolutions, while, for alfalfa, the increase in yield occurs in all the locations and for all the time periods and scenarios. The important decrease of grass production seems to be linked to high temperatures forecast in the south-west of France in the distant future whereas the difference in behaviour between crops could be due to alfalfa's rooting depth and nitrogen fixing ability.

Pattern of grass production along the year

The daily grass production is always earlier in spring, especially in the distant future and the warmest scenario (A2). The time-lag appears in all the studied stations. It is an effect of warming, allowing earlier leaf re-growth and production. The summer decrease is higher in the future than now and all the more in the distant future and the warmest scenario. It is probably mainly caused by the increase of temperature, reaching frequently adverse values in the south-west.



Conclusion

The main effects of climate change on forage production are changes in the dates of forage availability: earlier in spring, more in winter, less in summer. The effects on yields are different among regions in France and among scenarios and time in the future. An important result is the advantage of alfalfa over grass, because of its deep rooting system, which avoids serious water problems, allowing the use of the whole water reserve even in deep soils.

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