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Influence of climate variability on the forage production of a permanent grassland in the French Central Massif

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Calibrated for the conditions of the French Central Massif (site of Laqueuille), the grassland model PaSim (Pasture Simulation model) was used to simulate, for the period 1959-2015, the forage production of a mown grassland system under optimal management conditions, with hourly meteorological inputs extracted from the SAFRAN atmospheric database (8-km resolution). The aim was to generate purely climate-dependent time series of forage production. An extended analysis of the relationships between interannual forage yield variability and monthly climatic anomalies indicates that the highest forage production tends to be associated with brighter (enhanced incident solar radiation), colder and less humid weather conditions occurring during late-spring and early-summer (from May to July), and vice versa. SAFRAN and NCEP/NCAR re-analyses suggest that these seasonal climatic anomalies, observed locally, may be part of an anomalous large-scale atmospheric pattern characterized by positive (anticyclonic) surface pressure anomalies over the eastern north Atlantic and negative (cyclonic) pressure anomalies south of Scandinavia. Such anomalous atmospheric configuration obstructs the passage of
weather fronts (accompanied by cloudiness) over Western Europe and promotes the advection of cold/dry Arctic air over large parts of France. Overall, when simulated under optimum conditions, harvest yield values appear closely linked with these climatic anomalies, which tend to appear a few months in advance. This study supports the establishment of predictions of seasonal forage production in the French Central Massif, making use of reliable predictions of these climatic anomalies and projections of their frequency and intensity under future climate.

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