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Grasses are the main botanical component of grasslands, a major plant community covering a surface of approximately 3.3 billion hectares. The phenology of grasses is crucial for understanding the variations of both quantity and quality of the biomass in grasslands. In temperate regions, both the start of growth in winter and the maximum production at the end of spring are linked to flowering, which is induced by the exposition to specific conditions of temperature and photoperiod. However, current simulation models of biomass production poorly account for floral induction, which impedeces the assessement of interannual climatic variations and climate change impacts on grassland production and management. In particular, these models focus on the canopy scale, which makes themselves ineffective in accounting for the diversity of tiller in regards to their phenological state.

In order to better simulate grassland phenology, we propose an approach, which accounts for tiller demography and functioning in relation with environmental conditions. Based on a Functional Structural Plant Model calibrated for ryegrass (L-Grass model), we aimed at simulating the floral induction and growth of individual tiller, from apex initiation to spike appearance.

The L-Grass model simulates the vegetative growth of individual tillers of multiple phenotypes based on the concept of self-organisation i.e. the length of the pseudostem drives some morphogenetic dynamics such as leaf length and the timing of leaf and tiller recruitment. The model leads to realistic 3D virtual canopies that can be used to calculate radiation interception and biomass of each tiller. From this initial version, we implemented a sub-model of floral transition at apex scale and its consequences on each tiller morphology and development. Floral induction of each apex is calculated independently according to the temperature and photoperiod. Depending on these factors, a final number of both vegetative (internode, leaf and lateral apex) and reproductive phytomers (internode and spikelet) is calculated, inducing a potential delay in floral transition between tillers. Finally, spike heading is simulated according to the floral transition date and the elongation rate of internodes, which mainly depends on temperature. The first simulation outputs of the model are described.