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A generic probability based algorithm to derive regional patterns of crops in time and space

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Croplands are not only the key to human food supply, they also change the biophysical and biogeochemical properties of the land surface leading to changes in the water cycle, energy partitioning, influence soil erosion and substantially contribute to the amount of greenhouse gases entering the atmosphere. The effects of croplands on the environment depend on the type of crop and the associated management which both are related to the site conditions, economic boundary settings as well as preferences of individual farmers. However, at a given point of time the pattern of crops in a landscape is not only determined by environmental and socioeconomic conditions but also by the compatibility to the crops which had been grown in the years before at the current field and its surrounding cropping area. The crop compatibility is driven by factors like pests and diseases, crop driven changes in soil structure and timing of cultivation steps. Given these effects of crops on the biochemical cycle and their interdependence with the mentioned boundary conditions, there is a demand in the regional and global modelling community to account for these regional patterns. Here we present a Bayesian crop distribution generator algorithm that is used to calculate the combined and conditional probability for a crop to appear in time and space using sparse and disparate information. The input information to define the most probable crop per year and grid cell is based on combined probabilities derived from the a crop transition matrix representing good agricultural practice, crop specific soil suitability derived from the European soil database and statistical information about harvested area from the Eurostat database. The reported Eurostat crop area also provides the target proportion to be matched by the algorithm on the level of administrative units (Nomenclature des Unités Territoriales Statistiques - NUTS). The algorithm is applied for the EU27 to derive regional spatial and temporal patterns of crops on a grid basis. Here we provide an insight into the general approach and some application examples to evaluate the system behaviour.