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A cultivated planet in 2010 – Part 1: The global synergy cropland map

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Abstract. Information on global cropland distribution and agricultural production is critical for the world's agricultural monitoring and food security. We present datasets of cropland extent and agricultural production in a two-paper series of a cultivated planet in 2010. In the first part, we propose a new Self-adapting Statistics Allocation Model (SASAM) to develop the global map of cropland distribution. SASAM is based on the fusion of multiple existing cropland maps and multilevel statistics of the cropland area, which is independent of training samples. First, cropland area statistics are used to rank the input cropland maps, and then a scoring table is built to indicate the agreement among the input datasets. Secondly, statistics are allocated adaptively to the pixels with higher agreement scores until the cumulative cropland area is close to the statistics. The multilevel allocation results are then integrated to obtain the extent of cropland. We applied SASAM to produce a global cropland synergy map with a 500 m spatial resolution for circa 2010. The accuracy assessments show that the synergy map has higher accuracy than the input datasets and better consistency with the cropland statistics. The synergy cropland map is available via an open-data repository (https://doi.org/10.7910/DVN/ZWSFAA; Lu et al., 2020). This new cropland map has been used as an essential input to the Spatial Production Allocation Model (SPAM) for producing the global dataset of agricultural production for circa 2010, which is described in the second part of the two-paper series.

1 Introduction

Agricultural land satisfies global demands for human food, stock feed, and biofuel, which are increasing at an unprecedented rate with the continuing population and consumption growth (Gibbs et al., 2010; Godfray et al., 2010). Feeding the growing population and meeting these rising consumption demands remain a great challenge (Kastner et al., 2012; Zhang et al., 2016; Gao and Bryan., 2017). Accurate spatial information about cropland is vital baseline information for agricultural monitoring and food security (Eitelberg et al., 2015; Yu et al., 2019). Satellite-derived land cover datasets have been widely used for this purpose. For example, the Famine Early Warning Systems Network funded by