A MATLAB Toolbox for Automatically Importing ISO 11783 ISOXML Files - Abstract

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Summary

The use of ISO 11783 (commonly designated as ISOBUS) is rapidly increasing among modern agricultural machinery making it nowadays an important standard in agricultural engineering and a powerful tool in the digitization of agriculture. An important component of ISOBUS related to Precision Agriculture and variable rate applications is the Task Controller (TC) that is responsible for the proper application of the different rates based on the position data that is receiving from the Global Navigation Satellite System (GNSS). The TC is responsible for implementing the strategy that is described in the prescription map (uploaded to the Virtual Terminal (VT)), and at the same time for recording the as-applied data, as this information is transmitted from the Electronic Control Unit (ECU) of the implement (spreader, sprayer, etc.). The information is recorded in an Extensible Markup Language (XML) format based on the ISOBUS standard and is available at the VT as soon as the agricultural operation (Task) is finalized.

Although ISOXML converters to shapefile format (.shp) already exist, their output is still difficult to be utilized for research purposes. In the present work, a set of MATLAB functions were developed that could identify the information that exists in an ISOXML file and import these data into MATLAB in a structured manner and according to the user needs. The MATLAB functions were tested under site-specific fertilization in winter wheat by importing the data from the produced ISOXML files into MATLAB for further analysis. The developed toolbox allowed the comparison of the prescribed map for site-specific fertilization to the as-applied map that the centrifugal fertilizer spreader actually performed. This is extremely beneficial for agricultural machinery manufactures in their efforts to optimize the machine design but also to agronomists that develop the prescription maps as the map resolution is still a question that is not easy to answer and substantially depends on the machine performance.

One other important advantage of the developed MATLAB functions is that they can also be used to detect in real-time the values that are related to the application of the fertilizer in terms of dose rates and dynamic machine settings that are commonly being recorded by the Task Controller and are available to the user only after the end of the agricultural operation. This requires proper data extraction by detecting the corresponding Data Dictionary Identification (DDI) values. A task that is not

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straightforward and requires a laborious examination of the produced binary files that are defined in the ISOBUS standard. The added value in obtaining these figures in real-time lies within the fact that the as-applied dose rates, in conjunction with the machine dynamic behaviour, could be analyzed to optimize the variable rate application in terms of machine settings.

Keywords: digital farming; ISOBUS; site-specific application; variable rate fertilization.