Introduction

Against the background of population growth and climate change, Sub-Saharan African (SSA) wetlands are increasingly considered as a possible improvement to food security. Although wetlands are already part of national and regional agricultural policies, there is still an information gap on their location, physical and land use characteristics, which can be closed through remote sensing technology. In order to reflect wetland variability in space and time, the use of time series is imperative. The goals of this study were:

- The development of a mainly automatic EO-based tropical wetland delineation and characterization scheme which reflects wetland variability
- The creation of national-scale baseline data for Rwanda at a high spatial resolution (10-30 m)

Methodology

Wetland Delineation
- An object-based approach was applied to a previously developed potential wetlands layer and NDVI and NDWI from a 2017 Sentinel-2 composite; manual editing improved the result
- Validation: 255 randomly selected delineation slices were compared to wetland area digitized from RapidEye imagery with a median agreement of 84.71 %

Surface Water Occurrence (SWO)
- 60 Sentinel-1 SAR images (IW, VV polarization) from 2014 to 2017 were speckle-filtered and each scene classified by applying an Otsu threshold \(^1\) in Google Earth Engine; water frequency was calculated across this time series
- Permanent water bodies were derived from the 5th percentile
- Validation: 2 individual classifications were validated against manually digitized water in 4 RapidEye tiles resulting in a 94.77 % overlap

Wetland Use Intensity (WUI)
- The Mean Absolute Spectral Dynamics (MASD\(^2\)) algorithm was adapted to wetland ecosystems and created from multiple cloud and cloud shadow masked Sentinel-2 images from 2017
- WUI was compared to the legal use status of to-date mapped wetlands as obtained from the Rwandan Environment Management Authority (REMA)

Vegetation Response
- The NDVI was calculated from a cloud-masked time series of Sentinel-2 images in Google Earth Engine from 2016 to 2019
- The 20th, 50th and 90th percentiles were derived to capture vegetation response to different flooding regimes and wetland use types

Results

The developed approach for tropical wetland characterization provides nationwide data for agricultural planning and monitoring at different scales.