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| Modelling the future growth of trees based on the airborne laser scanning based metrics |
| Forests have a significant role in climate change mitigation as they act as carbon sinks and storages. More accurate estimates of forest growth and the climate effects of local forest operations are needed for carbon-neutral and climate-friendly forest management. Therefore, there is a need for new growth models that provide reliable decision support.  Growth is one often predicted tree variable and it has been examined in previous studies with growth models that have been developed both for tree- and stand level. Growth characteristics can be used either at the past forest growth monitoring or in the future forest growth prediction models. Typical predictors in growth models include tree diameter, site quality, competition index (e.g., the basal area of larger trees) and spatial competition indexes. A less studied alternative to using remotely sensed data in growth models is the prediction of future growth directly from the remotely sensed data. It is also possible to combine these data sources. In growth prediction, there is always a lot of uncertainty due to the limited amount of predictive information and high natural variation in forest growth.  In this study future growth prediction is considered. Our aim is to use the most recent remote sensing materials to predict 5-year tree growth directly from the current and past remote sensing data. In combination with biological knowledge and spatial description of forests, we develop a new-generation forest growth model for practical decision support. Our hypothesis is that new lidar derived predictors for growth that include e.g. past development and spatial neighbourhood of the modelled tree are better than the conventional predictors.  Our data includes 37 field measured plots including tree locations, species, heights and diameters. Field plots have been measured in 2009, 2014 and 2019. Airborne laser scanning data (ALS) is available from the study area from the first two years. For the modelling, individual tree detection from ALS data is conducted. Tree level predictor variables are calculated from tree-wise point clouds. ALS features at the beginning of the growth period, past development of ALS features before the actual growth prediction period and tree- and forest level features are used in the development of the new growth model.  We analysed the significance of different ALS based metrics as the explanatory variables for the incoming diameter increment. Our preliminary results showed that especially the development of the height means, the lowest and the highest height percentiles and the lowest and the highest intensity percentiles seemed to be significant. Metrics based on the first and only echoes seemed to be more significant than metrics based on the last and only echoes. |