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| **Comparison of satellite- and drone-based SAR imaging of forest** |
| **Introduction/Aim:**  Synthetic Aperture Radar (SAR) has been a longstanding tool for global forest monitoring when used from satellites. In Sweden, boreal forests are comprehensively characterized using airborne laser scanning and photography. As a result, SAR's contribution is somewhat limited due to its lower resolution compared to other sensors, despite its ability to acquire data in all weather conditions. However, by addressing various interfering factors that currently diminish the quality of SAR images, it can prove highly beneficial for vegetation mapping. In the current work, we compare SAR images acquired from satellites with those acquired from a drone, and we raise the discussion on how to enable useful applications based on satellite based SAR.  **Methods:**  Satellite images were acquired at X- (ICEYE, COSMO-SkyMed, TanDEM-X), C- (Sentinel-1) and L-band (SAOCOM), respectively. The drone-borne multi-band SAR system acquired data in the P-, L- and C-bands. A helical flight trajectory enabled an accurate tomographic reconstruction in 3D as well as the generation of backscatter images. The spatial resolution was ~20 cm in the P-band, ~6 cm in the L-band, and ~2 cm in the C-band, while the resolution of the satellite images ranged from a few meters to about 20 meter. A forest area of about 0.6 ha were measured *in-situ* using a caliper and positioned using PosTex system and a GNSS receiver, and the biomass was estimated from national functions.  The backscatter across the different sensors will be compared and their correlation to AGB, land type, as well as the positional accuracy will be analysed. The positioning will be quantified by using two corner reflectors located within the forest area.  **Results:**  We expect the interferometric and tomographic information to provide useful information about the forest, to estimate biomass etc., while the backscatter at the shorter wavelengths are commonly greatly affected by speckle noise which in combination with the scattering in the forest make it less useful for biomass estimation. It is also important to understand the backscatter levels of the drone-based acquisitions in relation to satellite-based, to enable future up scaling based on the drone.  **Conclusion:**  Radar has an important role in mapping forests, but the usefulness is highly dependent on the configuration of the platform and radar. To fully enable the mapping at scale provided through satellite based SARs, the spatial resolution needs to be improved and the SARs need to provide more information than backscatter at a single polarization. This can, e.g., be bistatic SAR acquisitions and fully polarimetric data. |