Aboveground biomass retrieval in tropical forests – the potential of synergistic X- and L-band SAR data use

S. Englhart, V. Keuck, F. Siegert

Introduction

• Accurate biomass and carbon estimation is the most important requirement for Reducing Emissions from Deforestation and forest Degradation (REDD)
• Tropical forests cover ~15% of the Earth’s surface and contain up to 40% of terrestrial carbon (FAO 2009, Page et al. 2009)
• SAR systems are weather and daylight independent which is very advantageous in the tropics with frequent cloud coverage

Study area

• Study site in Central Kalimantan (298,745 ha), Borneo/Indonesia
• Located in flat, alluvial plains comprising peat swamp forests (intact, heavily degraded or regrowing)
• Peatlands have an enormous carbon storage: aboveground forest biomass and belowground peat deposits

Methods

• SAR data: calibration, co-registration, speckle filtering
• Up-scaling of biomass reference data: airborne LiDAR measurements were in turn calibrated to field inventory data (Kronseder et al. 2010)
• Biomass modeling of TerraSAR-X and PALSAR backscatter
  - mono- and multi-temporal
  - alone and in combination

Results and Discussion

 X- and L-band combined multi-temporal biomass estimation model achieved the best results
   multi-temporal models compensate extreme climatic conditions
   different penetration depths of X- and L-band signal into the vegetation (X-band signal more sensitive to low biomass, L-band signal more sensitive to high biomass) (Fig.4)
 Spatially and temporally transferable (Fig.3)
 Biomass estimation model valid up to 600 t/ha
   accuracy decreases at high biomass values
   up-scaling approach makes regression models powerful, even in high biomass ranges
   average biomass estimation of different forest types very accurate featuring the spatial distribution (Fig.3)

Study objectives

• Potential of combined X- and L-band SAR data use for aboveground biomass retrieval
• Up-scaling of biomass reference data:
  in-situ data ➔ LIDAR estimations ➔ SAR estimations

Table 1: Properties of remote sensing data used for the study in Central Kalimantan, Indonesia

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<th>Incidence Angle</th>
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