



## Polarimetric SAR Interferometry: Potential and Limitations for Biomass Estimation

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### Biomass Estimation



Cylinder Volume		Form factor 1=cylinder, 1/3=cone	Wood density .40-.55 softwoods .55-.80 hardwoods
Cross-section Area at breast height			
<b>Tree Biomass [1000kg] =</b>	$\pi \cdot (\frac{1}{4}dbh)^2 \cdot \text{height}$	$f_z \cdot$	$\rho$



$$\text{Forest Biomass [t/ha]} = \text{Basal area} \cdot \text{height}_{mid} \cdot f_z \cdot \rho_{mid}$$

= Sum of all tree biomasses per area unit (ha)

Cross-sect. area of all trees per area unit (ha)

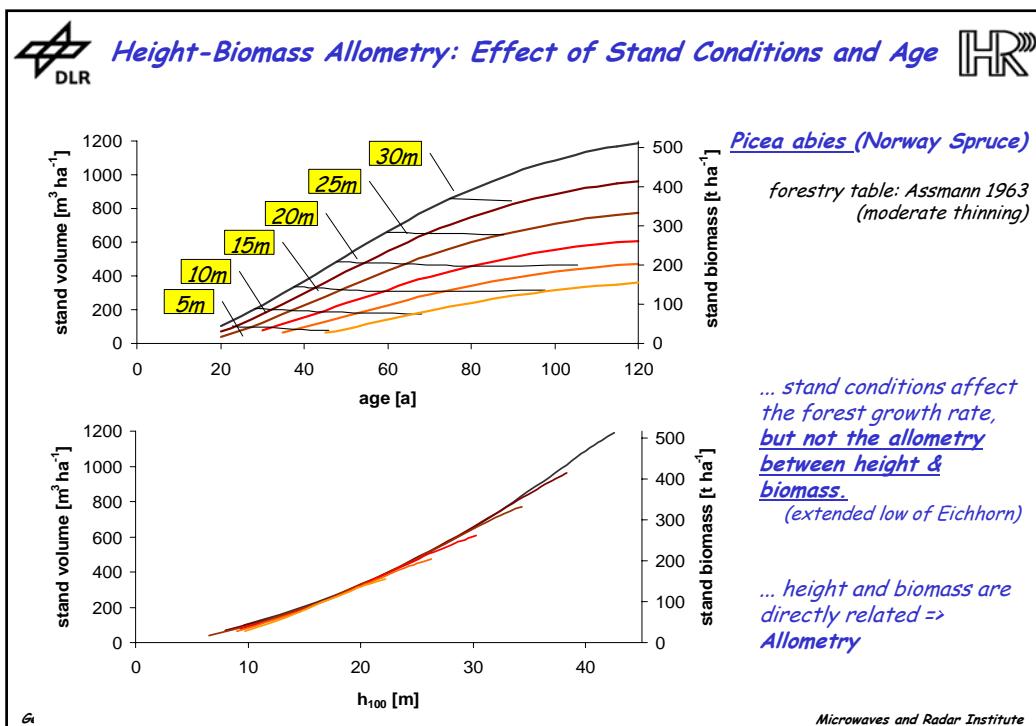
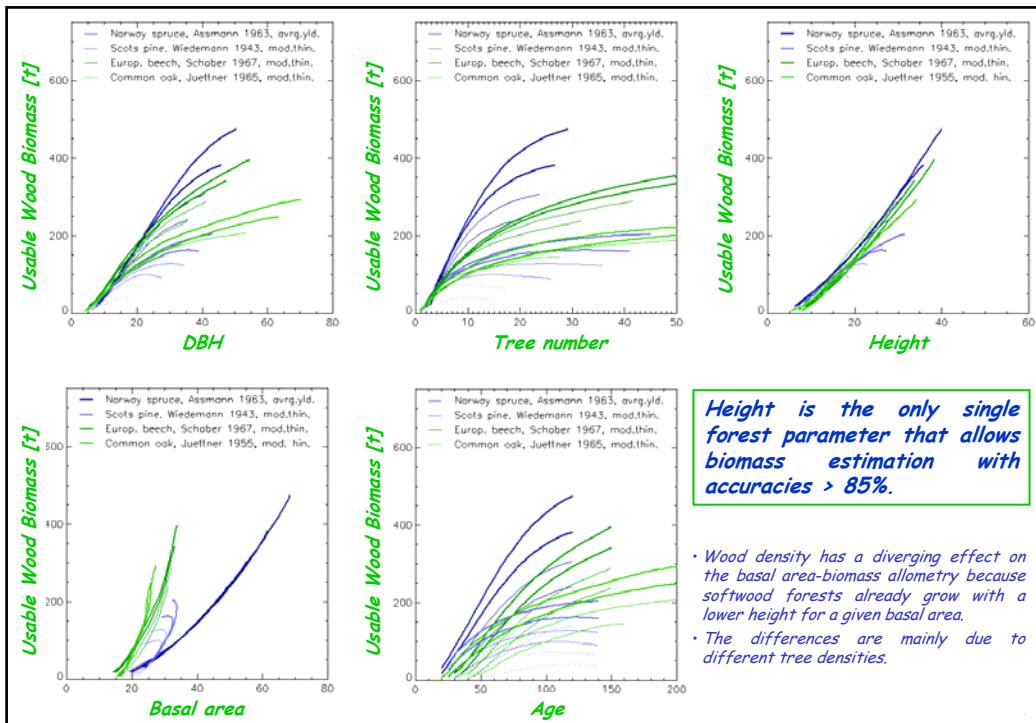
This formula is very easy to use for single-species single-layered forest systems (like in yield tables).

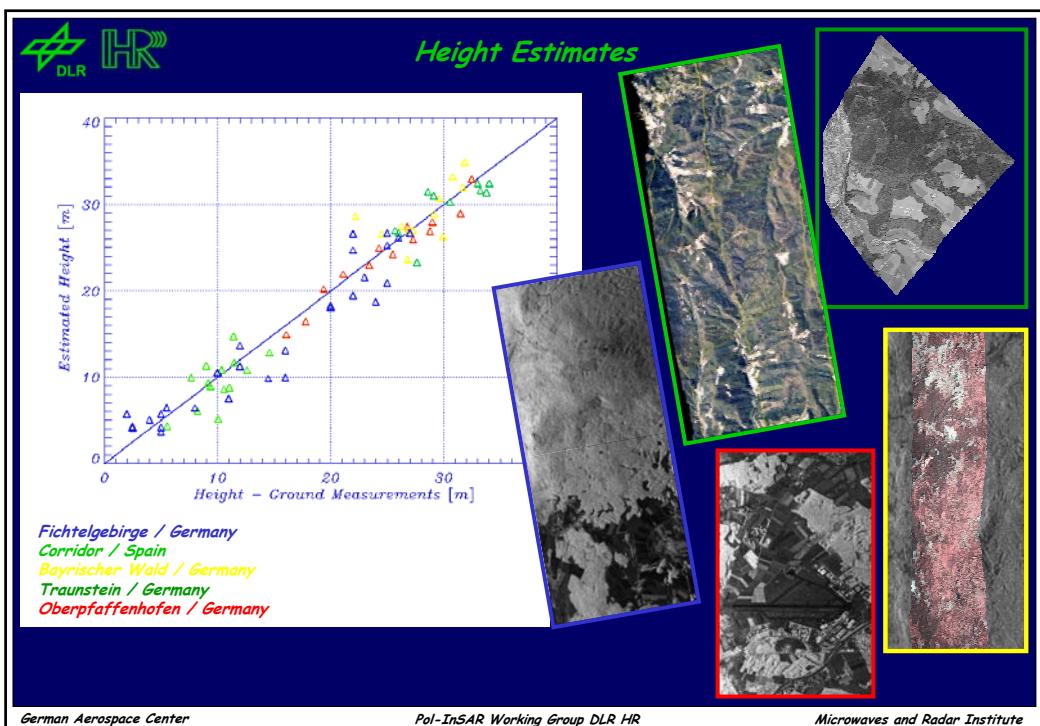
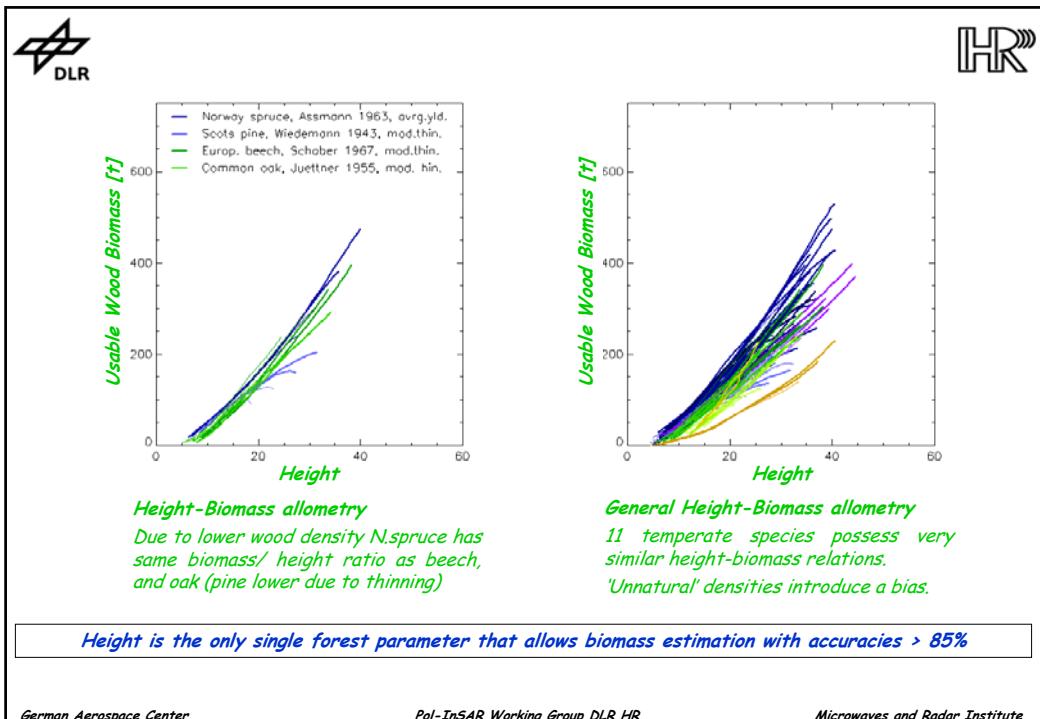
In heterogeneous forests,  $\text{height}_{mid}$  is difficult to calculate because it varies with forest structure, and for  $\rho_{mid}$  the softwood-hardwood ratio should be known at least.

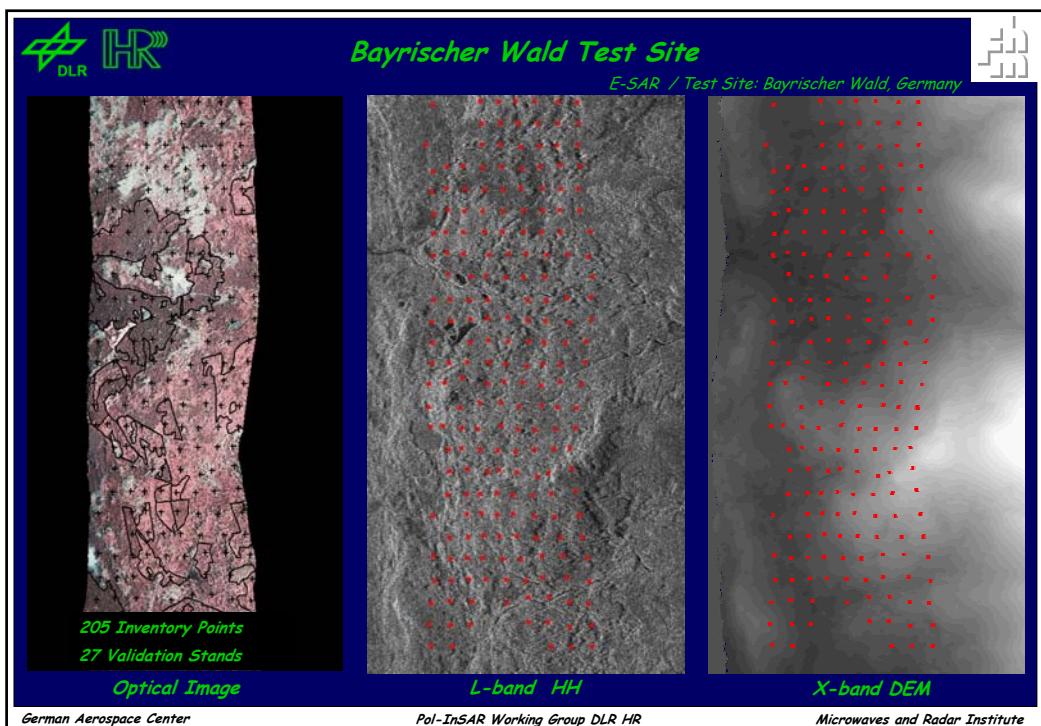
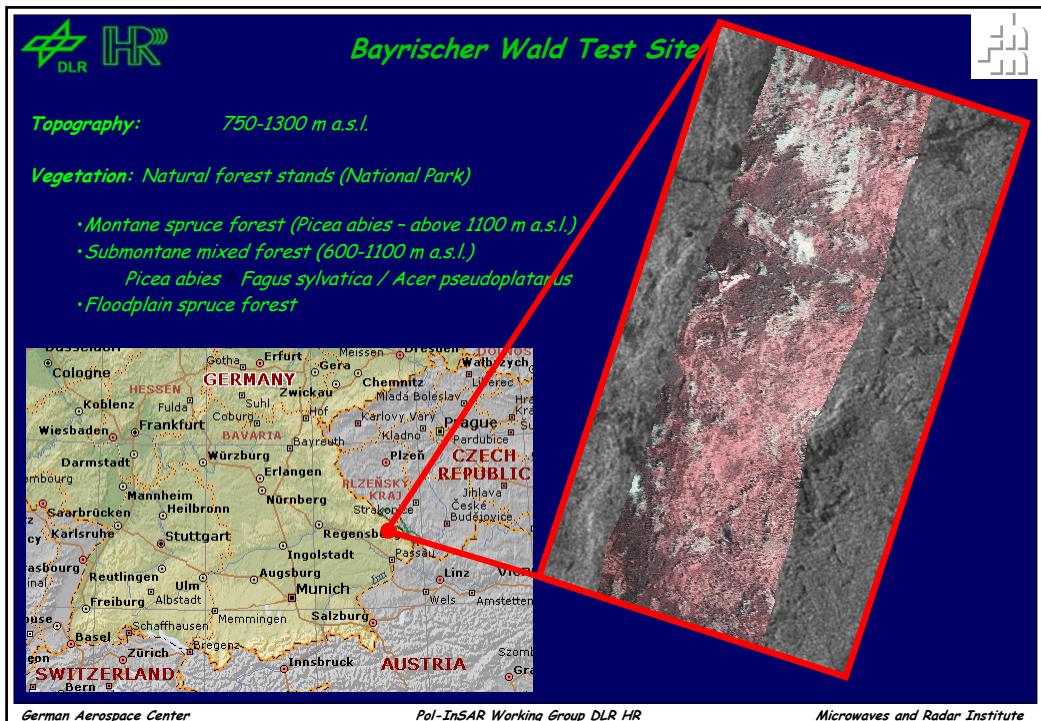
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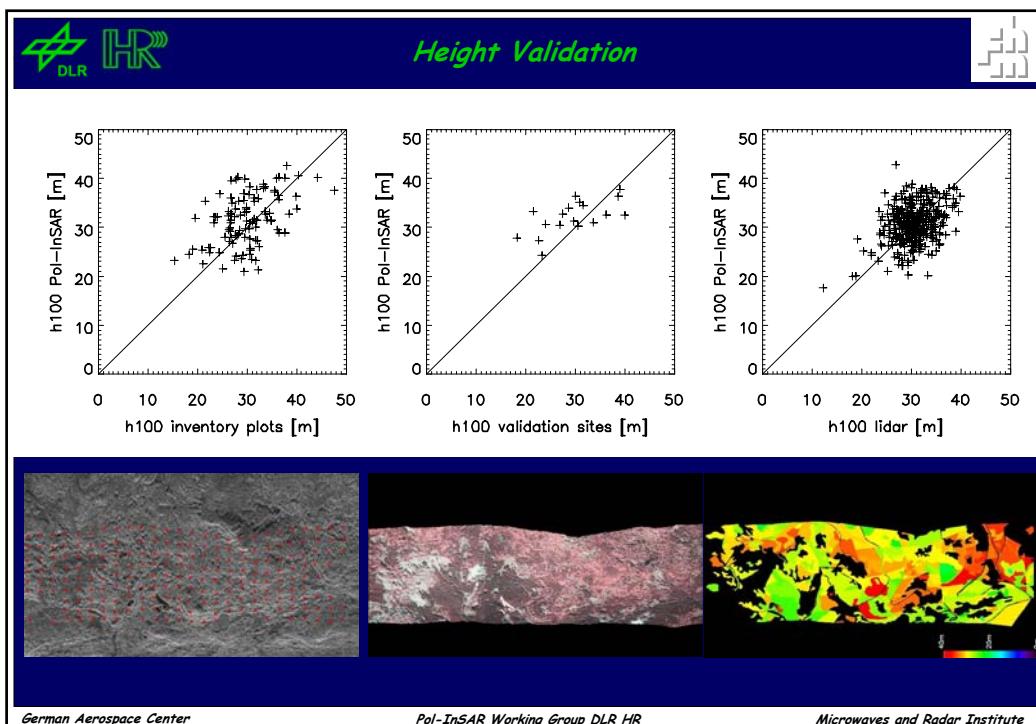
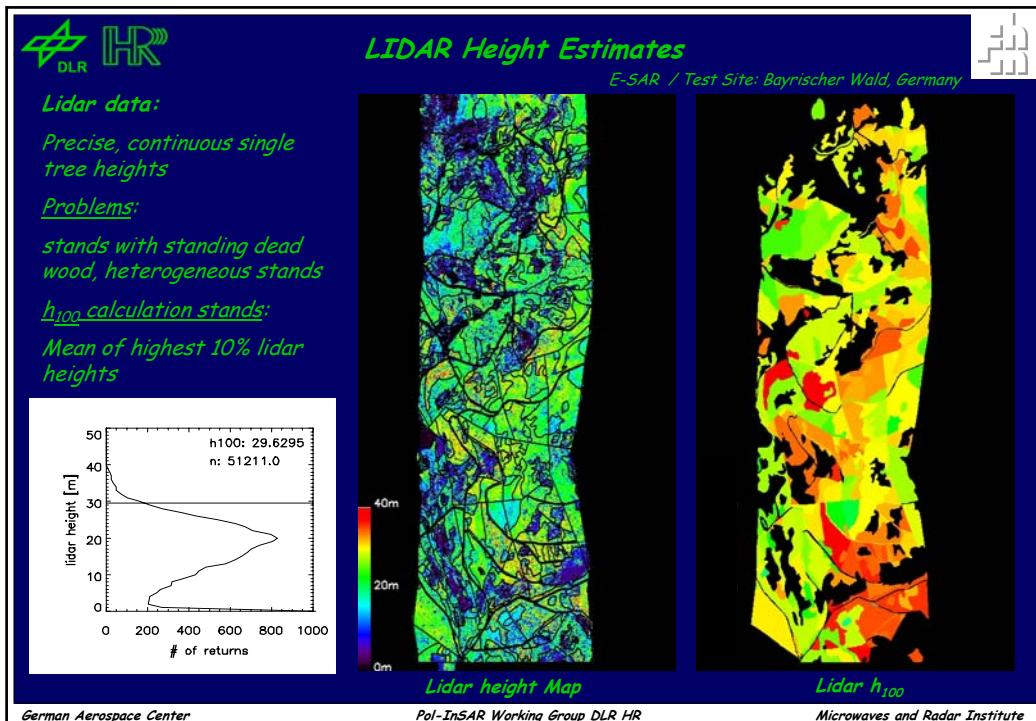
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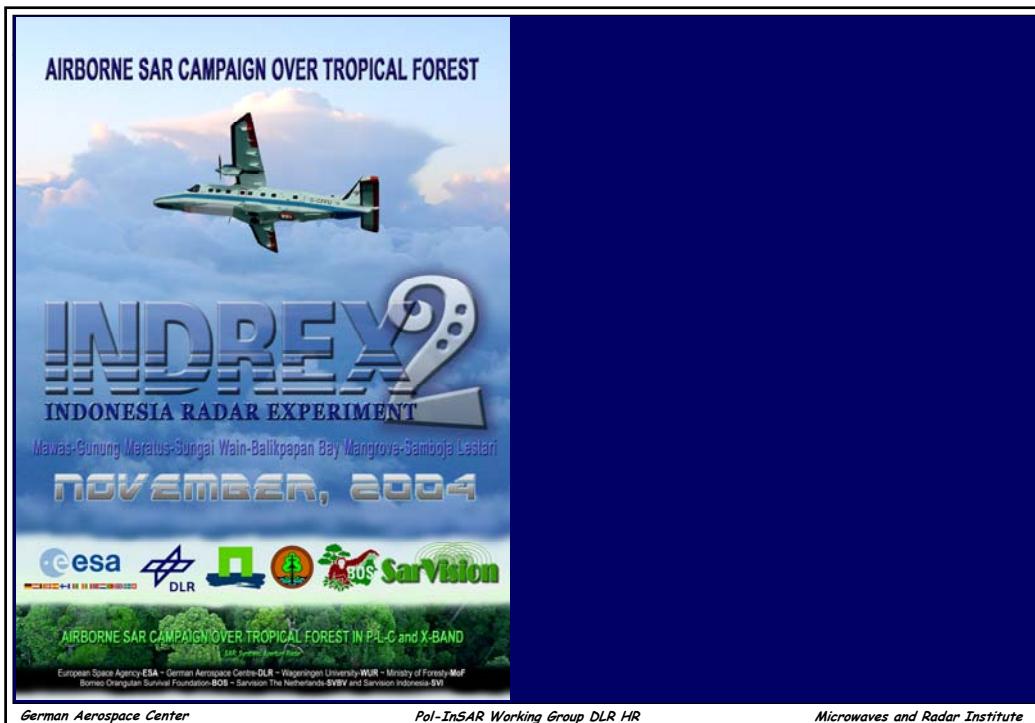
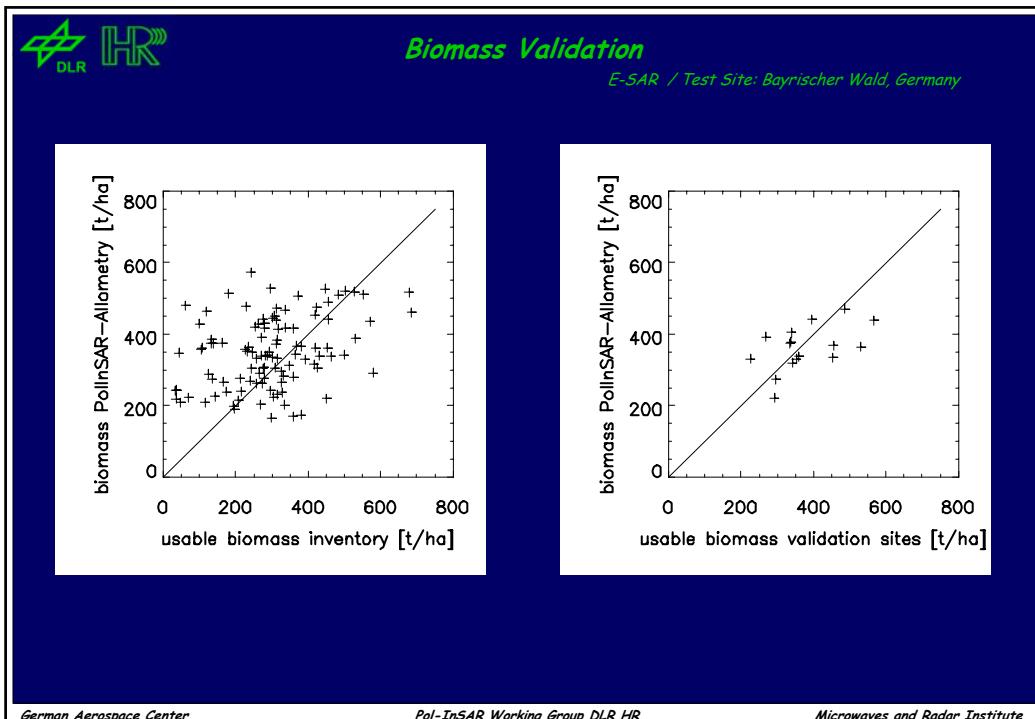
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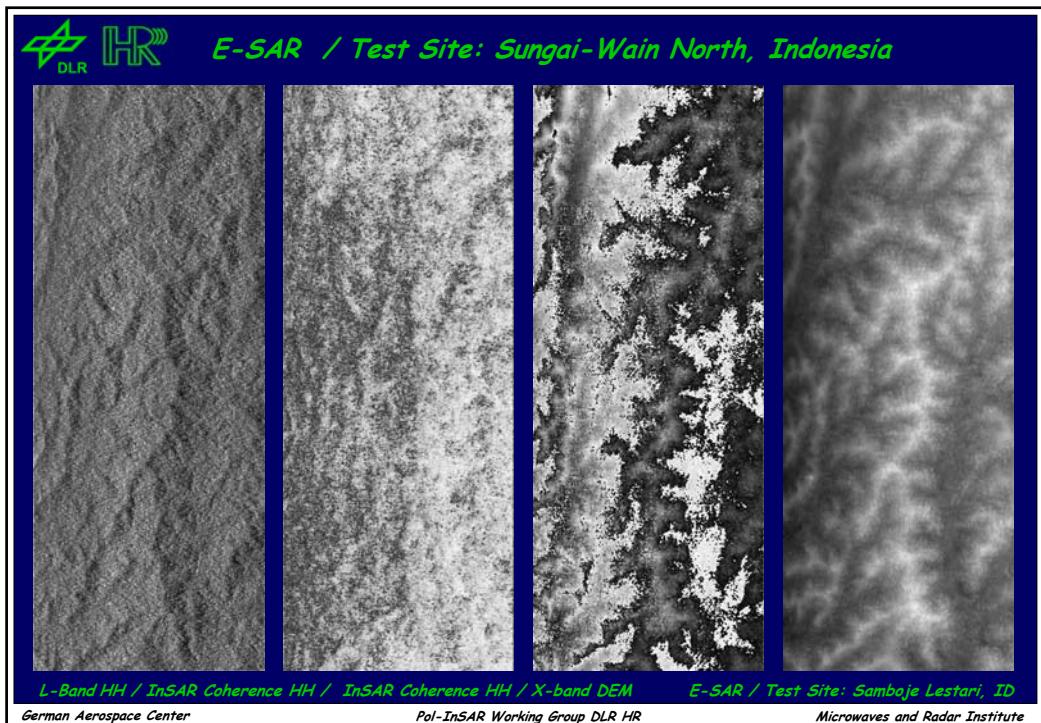
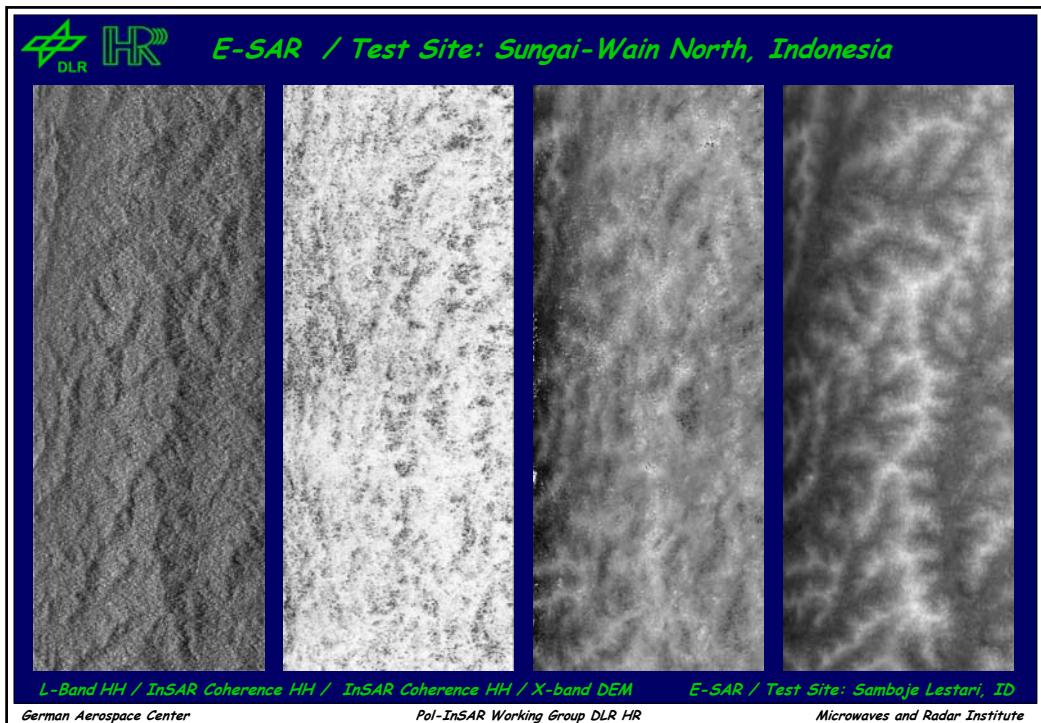


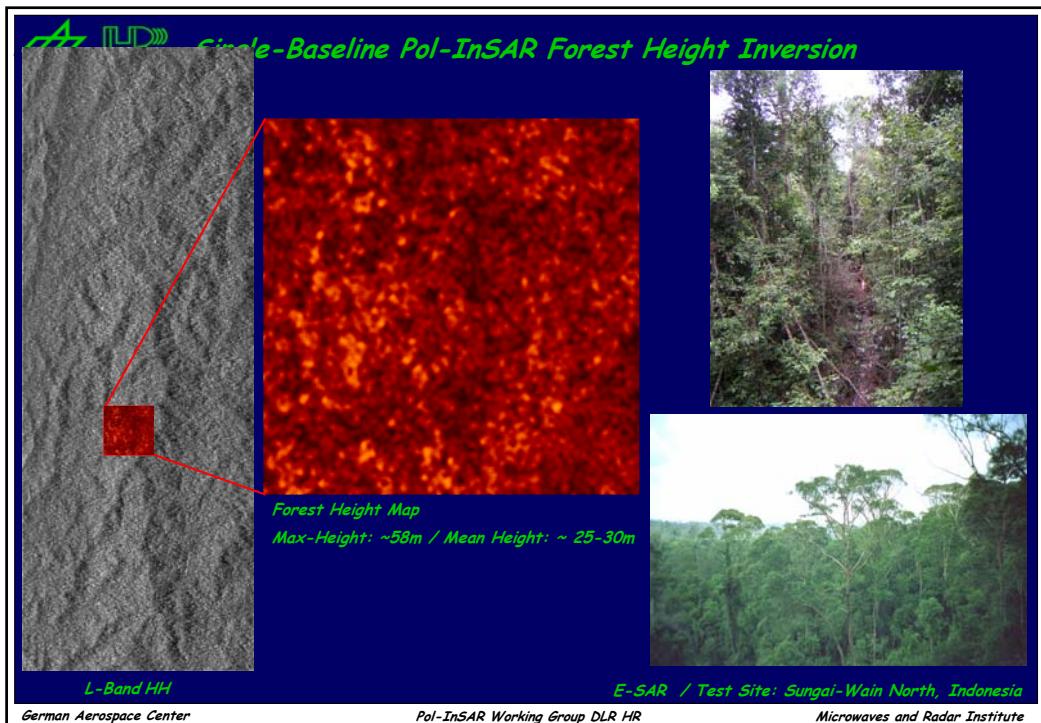
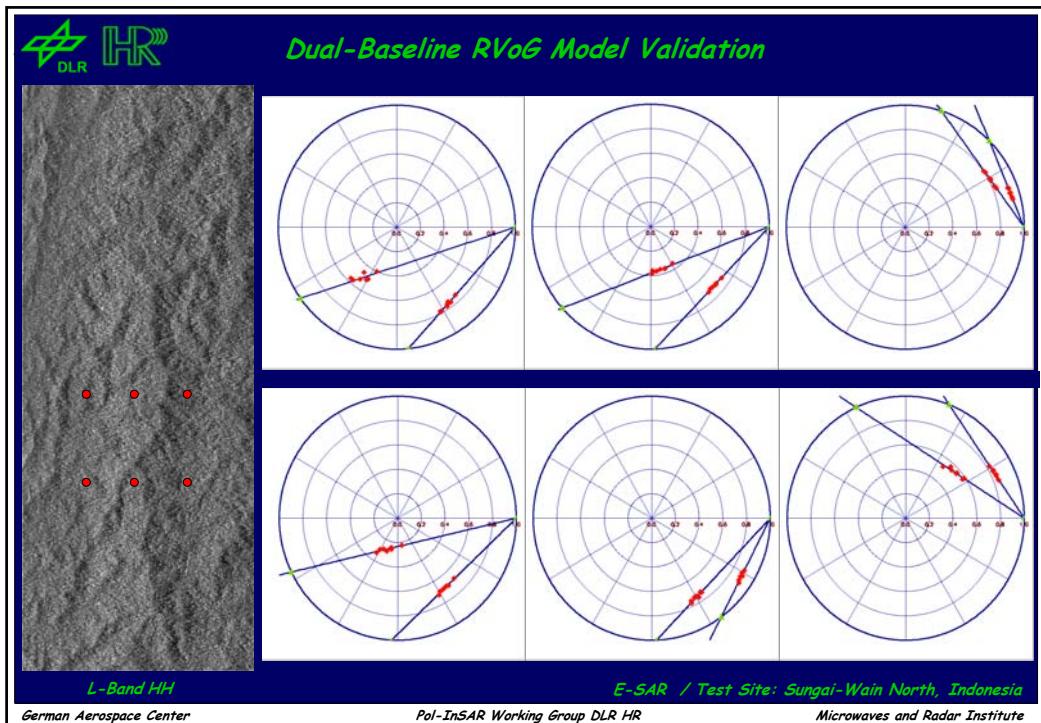














## Summary

*Height is the key parameter for biomass estimation.*

*Pol-InSAR -> Forest Height & Forest Height (+ ... ) -> Biomass*

*Height estimation from Pol-InSAR at L-band has been validated over several test sites with very different forest conditions in Europe. The estimation accuracy lies between 10-20%*

*Limitations / Open Questions:*

- Penetration of L-band into dense vegetation layers (tropics). ✓
- Height estimation in very sparse vegetation (tundra).
- Temporal Decorrelation in a repeat pass scenario.

*Height-biomass allometry for temperate even-aged single-species forests shows a very unique relation (+/-20%) regardless of species, site conditions and (conventional) thinning practises.*

*Height-biomass allometry in tropical environments is not established / validated*

*Tree Number is probably the most valuable partner for forest height towards biomass estimation*