Forest storm damage mapping with InSAR

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Storm damage in European forests 1860-2005

mill m$^3$

- 1875
- 1900
- 1925
- 1950
- 1975
- 2000
The forest affected by storm
Dagmar 26th December 2011

Data
• Forest resource map data
• Storm cleanup records
• Harvester track-log
• DTM, airborne laser scanning
• Tandem-X before and after
InSAR height decrease

Criteria:
Storm damage: 4 – 10 m decrease
Clear-cut: > 10 m -- « --
1. DTM from airborne laser scanning
2. Pre-storm DSM from Tandem-X against DTM
3. Post-storm DSM from Tandem-X against pre-storm DSM
4. Height change = Post-storm – Pre-storm DSMs
5. Compare with field records
From INT to reflattened, filtered dINT
InSAR height
0 – 20 m

Coherence
0.25 - 1
Classification based on height decrease

Clear cut
Storm damage
thinning

Colour scale 0 -10 m
Logging records: Harvester track log

700 m
Overall accuracy 87%
Kappa 0.47

<table>
<thead>
<tr>
<th>Classified</th>
<th>Ground truth</th>
<th>No change</th>
<th>Storm</th>
<th>Clear cut</th>
<th>Total</th>
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</tbody>
</table>
Map of storm damage and clear cuts January 2011 – March 2012

InSAR height change
Scale -10 - +10 m

Classified disturbances
On aerial image background

- Clear cut
- Storm damage
- Thinning
Fig. 1. Relationship between AGB and InSAR height from Tandem-X for 200 m² plots, fitted with a no-intercept regression model.
Spin-off 1: Timber volume wind-throw
Conclusions

• X-band bi-static InSAR data are promising for detection of storm damage in forests
• Based on change detection in DSM height
• Spin-offs:
  — Estimates for timber volum blown down
  — Risk for stormdamage can be made
• Limitation: steep terrain