Coherent vs. Persistent Scatterers: A Case Study.

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CSs Concept

CSs can be **defined** as scatterers with **point-like scattering behavior**;

- They are unaffected by multiple scattering effects;
- As point-like scatterers the CSs are characterized by a **correlated object spectrum**.

- Detection performed by exploiting spectral correlation properties addressed in terms of image sub-look (spectral) correlation;
- Detection quality related to the available system bandwidth;
- No temporal stability is assumed in their definition;
- Main applications: characterization of individual scatterers through their polarimetric properties, estimation of LOS rotation angle and dielectric constant.
Airborne CSs detection: Single-Pol (HH), Quad-Pol, Multi-Frequency (L-, C-, X-Band)

Red: HH, Green: HV, Blue: VV

Munich

100 MHz system bandwidth
ALOS Data Set

Sensor: ALOS-PalSAR
Repeat Interval: 46 Days
Time period: 7.5 months.
System Bandwidth: 14MHz

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Dataset

Test site: Munich
Sensor: ERS
System
bandwidth: 16MHz

Start time: 27-APR-1992
End time: 22-AUG-2002
# Acquisitions: 86
Time period: 10 years
CSs detection in time

One image
Sub-look coherences

The mean sub-look Coherence is used for the detection

Sub-look1

Sub-look2

Stack
CSs detection
Correlation
Sub-look coherence – Amplitude
Correlation
Sub-look coherence – SCR
PSs Concept

- Natural stable scatterers over long time series of SAR data;
- They are characterized by a coherent behavior in the time;
- Possible exploitation of large datasets independently from baseline or temporal separation;
- Detection quality related to high number of acquisitions;
- Enabled the development of many interferometric application: velocity terrain displacements evaluation, accurate DEM generation ecc.
PSs and CSs detection
PSs and CSs detection
PSs vs. CSs: Amplitude
PSs vs. CSs: Amplitude
PSs vs. CSs: SCR

![SCR histogram graphs](image-url)
PSs vs. CSs: Sub-look coherence
PS velocity displacement map
CSs velocity displacement map
Deformation estimation comparison

Mean Velocity (mm/yr)

<table>
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<tr>
<th>PSs</th>
<th>CSs</th>
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<td>-0.37</td>
<td>-0.98</td>
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Conclusions

- The CSs detection performed with narrow system bandwidth, also if maybe non optimal, has been demonstrated;
- Stable CSs were found to be present in SAR images acquired over a long time period;
- The CSs amplitude signal and its correlation with the CSs sub-look coherence has been evaluated while no correlation has been found between CSs sub-look coherence and SCR;
- The relation between CSs and PSs have been analyzed in term of their location in the scene, backscattered signal amplitude, SCR as well as amount of sub-look coherence;
- The possibility to perform LOS velocity displacement evaluation by means of CSs have been also investigated.