InSAR Scatterer Identification and Analysis using Combined InSAR and Laser Data

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Propositions

1. Single scatterers matter
2. We need to know what we are measuring
3. Contextual information is a necessity, (not a “nice-to-have”)

Surface deformation map, the Netherlands

Terrasar-X data (m = 127) results: (Rotterdam, the Netherlands)

Linear velocity map
Challenge the future
Linear velocity map

Class: Linear
Class: Linear + seasonal
Class: Linear + seasonal + jump
Class: Linear + jump

Real-time monitoring: Shopping mall Heerlen

Part of shopping center demolished

Sinkhole causing collapse of a building

PS1
PS2

Chang, L. & Hanssen, R. F. Detection of cavity migration and sinkhole risk using radar interferometric time series
...a single scatterer may matter!

- Interpretation becomes key
- Associating scatterers with objects
- Currently, scatterers are 'free flowing'

Precise Point Positioning

Corrections radar
- Ellipsoid WGS84
- Geoid EGM96
- DEM SRTM
- Solid Earth tides
- Ocean loading
- Hydrological loading
- Pressure loading
- Plate motion

Precise Point Positioning for TerraSAR-X stripmap

Precise Point positioning in azimuth and range

Covariance matrix / Confidence ellipsoid

\[ Q_{\text{cov}} = R_{\text{cov}} Q_{\text{cov}}^T = \begin{bmatrix} \sigma_x^2 & \sigma_{xy} & \sigma_{xz} \\ \sigma_{yx} & \sigma_y^2 & \sigma_{yz} \\ \sigma_{zx} & \sigma_{zy} & \sigma_z^2 \end{bmatrix} \]
### PPP in azimuth and range

- **Azimuth:** -4.8 ± 8.6 cm
- **Range:** 32.6 ± 4.0 cm

- **Azimuth:** -1.7 ± 6.8 cm
- **Range:** 32.3 ± 2.2 cm

### 3D precision and accuracy

- **Corner Reflector 6**
  - **Accuracy:** 1.12 m
  - **Axis ratio (r/a/c):** 1/2/129

- **Corner Reflector 7**
  - **Accuracy:** 0.66 m
  - **Axis ratio (r/a/c):** 1/3/213

### InSAR and Airborne Laser Scanning

- **“Snap” to object**

- **“Snap” to object**
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