Data selection and interferometric baselines

Rüdiger Gens
Data formats

- CEOS single look complex
  - does not require SAR processing
  - order deskewed (zero Doppler)

- CEOS level 0
  - frame based
  - requires SAR processing
Data formats

• Sky Telemetry format (STF)
  • swath data format
  • requires SAR processing
  • allows latitude constraints
  • flexible to cover any area of interest in azimuth direction
  • format of choice
Wavelength

- Wavelength determines penetration depth
- Shorter wavelengths are backscattered at the surface
- Longer wavelengths reach the topographic surface (sub-surface)
Polarization

- **Radarsat:**
  HH polarization better suited for sea ice

- **ERS:**
  VV polarization for observation of the oceans
Data availability

- **Repeat cycle**
  - ERS-1/2: 35 days
  - Radarsat: 24 days
  - JERS-1: 44 days

- **Time**
  - ERS-1/2: 1991 until present
  - Radarsat: 1995 until present
  - JERS-1: 1992 to 1998
Resolution

- best ground resolution
  - Radarsat: 8 m
  - ERS-1/2, ENVISAT: 30 m
  - JERS-1: 30 m

- coverage
  - Radarsat: 500 x 500 km (ScanSAR)
  - ERS-1/2: 100 x 100 km
  - ENVISAT: 100 x 100 km
  - JERS-1: 75 x 75 km
Precise state vectors

- available for ERS-1/2 data
  - German Aerospace Center (DLR), Germany
  - Technical University Delft, the Netherlands
- effect on DEM accuracy caused by baseline decorrelation smaller than one meter
Interferometric baseline

- different representations
  - length $B$ and the orientation angle $\alpha$
  - horizontal ($B_y$) and vertical ($B_z$) component
  - components ($B_\parallel$) and ($B_\perp$) component
Interferometric baseline

- applicability for applications (example ERS)

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<th>Baseline</th>
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<td>Practical InSAR limit</td>
<td>$&lt; B_{\text{perp}} &lt; 600$ m</td>
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<td>Digital Terrain Models</td>
<td>$150$ m $&lt; B_{\text{perp}} &lt; 300$ m</td>
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Interferometric baseline

- critical baseline
  - for interferometric pairs with a perpendicular baseline $B_\perp$ beyond a critical value, correlation vanishes because the spectral shift exceeds the pulse bandwidth
Interferometric baseline

- critical baseline
  - loss of all coherence

\[ B_c = \frac{\lambda r}{2 R_y \cos^2 \theta} \]

- wavelength \( \lambda \)
- range \( r \)
- resolution in range \( R_y \)
- look angle \( \theta \)
Interferometric baseline

- perpendicular baseline component $B_\perp$ can be used to describe the sensitivity of an interferometric pair to topographic elevation
- large parallel baseline component $B_\parallel$ will produce a high background fringe rate due to “flat” topography – needs to be known quite accurately to get a topographic map with no cross-track tilt
Data selection

Descw
Radarsat baseline catalog

Radarsat-1 interferometric baseline catalog

This interface lets you search for available interferometric pairs in the ASF archive using a world map which has been divided in 5x5° grids. Grids for which interferometric pairs are available are highlighted in dark tones. Clicking on the individual grid cell will allow you to download the baseline information as a zipped text file and a zipped ArcGIS shape file. Baselines can also be searched using a text only version.

Beam mode: F1N1
 Orbit direction: Ascending

Latitude (deg):  
Longitude (deg):  

http://www.asf.alaska.edu/baselines/
Radarsat baseline catalog

RADARSAT-1: InSAR Coverage for ASF Station Mask
Example: Descending ST2 orbits with 24 days repeat cycle

Legend
- InSAR Pairs
  - 1
  - 2
  - 3
  - 4
  - 5
  - >5