An Overview of Imaging Radar and Commercial Space Systems

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THE UNITED STATES OF AMERICA
For Radar
Clouds Don’t Matter

Properly selected radar frequencies are not affected by the atmosphere

Clouds, dust, gas content, rain
Other Useful Properties

- Sunlight not needed
  - Active sensor that provides its own illumination

- Synthetic Aperture Radar (SAR) technique provides high resolution
  - Resolution is based on the characteristics of the pulses and collection time
  - Distance does not degrade resolution

- There is no lens... So, flexible resolution and coverage in one system
  - High resolution, small area
  - Mid resolution, medium area
  - Low resolution, large area

- Coherent nature of radar energy
  - Harmonic synchronicity
# The New Commercial Space Radars

<table>
<thead>
<tr>
<th></th>
<th>RADARSAT2</th>
<th>TerraSAR-X TanDEM-X</th>
<th>Cosmo-Skymed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Launch Date</td>
<td>14 Dec 2007</td>
<td>15 July 2007</td>
<td>8 Jun and 12 Dec 2007</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21 June 2010</td>
<td>25 Oct 08, 5 Nov 2010</td>
</tr>
<tr>
<td>Frequency Band</td>
<td>C-Band</td>
<td>X-Band</td>
<td>X-Band</td>
</tr>
<tr>
<td>Channel Polarization</td>
<td>Quad</td>
<td>Dual</td>
<td>Dual</td>
</tr>
<tr>
<td>Nominal Target</td>
<td>3 days</td>
<td>2.5 days</td>
<td>0.5 days (4 vehicles)</td>
</tr>
<tr>
<td>Revisit Time at</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mid-latitudes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Best Resolution</td>
<td>0.8 m x 3 m</td>
<td>1 m</td>
<td>1 m</td>
</tr>
<tr>
<td>Widest Swath</td>
<td>500 km</td>
<td>100 km</td>
<td>200 km</td>
</tr>
</tbody>
</table>

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Cosmo Skymed  Strait of Gibraltar

Notice the geometry of collection...
Long duration exposure, side looking, long distance from ground area

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COSMO SkyMed
Strait of Gibraltar

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COSMO SkyMed ©ASI
Processed and distributed by e-GEOS

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COSMO SkyMed
Myanmar Flooding in Irawady River Delta
TerraSAR-X
Ships, Wakes, Displacement

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Strait of Gibraltar
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Cargo Ship

Ship direction of travel clearly visible

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THE UNITED STATES OF AMERICA
RADARSAT 2  Multi-Pol

Gulf of St Lawrence

RADARSAT 2
Mode: ScanSAR Narrow
Polarity:
Gulf of St Lawrence

RADARSAT 2
Mode: ScanSAR Narrow
Polarity: HH

Note the texture of the water returns. Notice any valuable information?

Perhaps we’d see it better if we could make the water disappear...

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Gulf of St Lawrence

RADARSAT 2
Mode: ScanSAR Narrow
Polarity: H

Mixed polarity... now use your ship detection software...
RADARSAT2
Quad Polarimetric, Brazil

HH, HV, VV, VH collected simultaneously
Three images projected through Red, Green, Blue color guns of monitor

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THE UNITED STATES OF AMERICA
TerraSAR-X
Palm Island, Dubai

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Colorized Surface Texture Image
TanDEM-X System
IFSAR Elevation Model, Mt Etna
Peterman Glacier... The Movie

Change Detection Series

Brought to you by Cosmo SkyMed
Slides show motion of glacier break up

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The Beautiful Sensor

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And ...

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The Beautiful Sensor

Radars emit waves in harmonic synchronicity

and the characteristics of the echoes are measured with exquisite precision
Thank You

Danke

Grazie