



# SAR images refocusing on specific grids for interferometric processing

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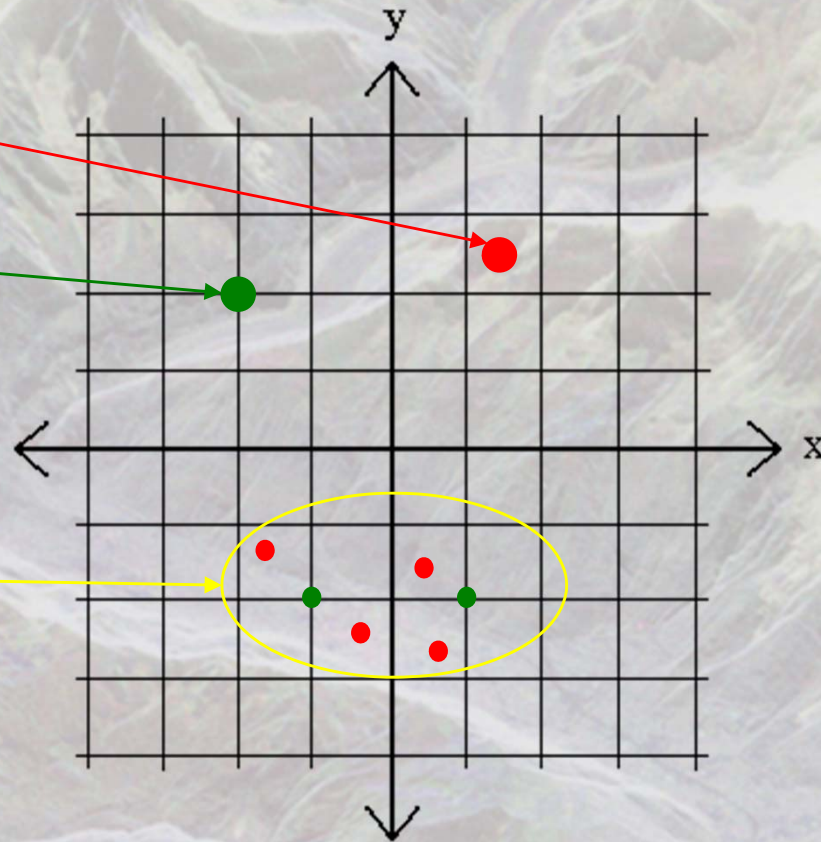
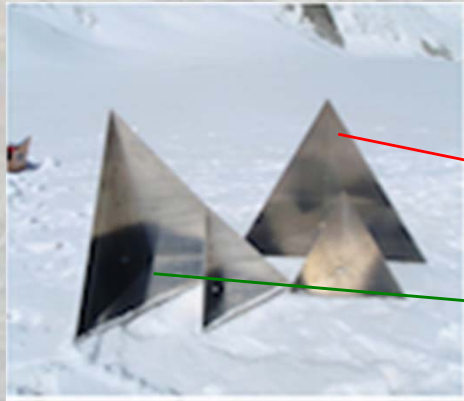
<sup>4</sup> *ONERA*

<sup>5</sup> *German Aerospace Center (DLR)*





# SAR Image Grid

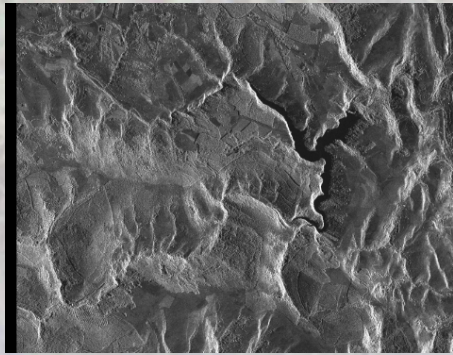


On ● -Grid Reflectors.  
Off ●

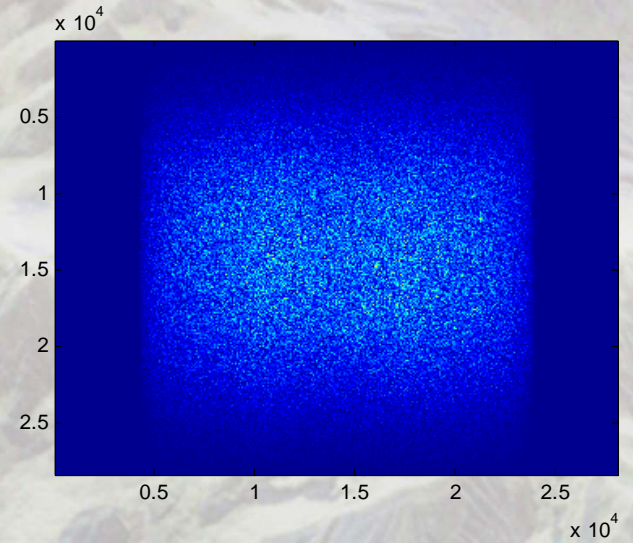
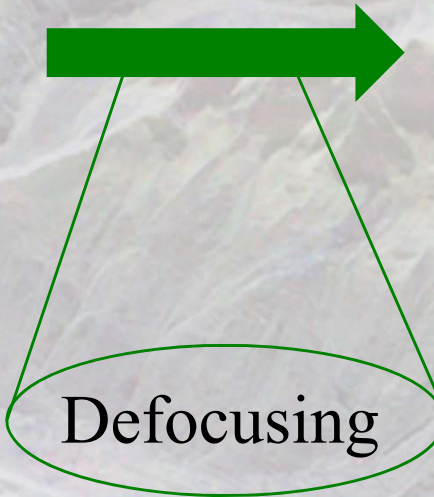
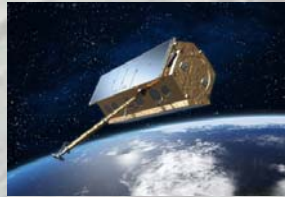
- Off-grid reflectors:
- Loss of contrast.
  - Ambiguous phase.
  - False target detections.



# SAR Image Defocusing



Flight Path



RAW data

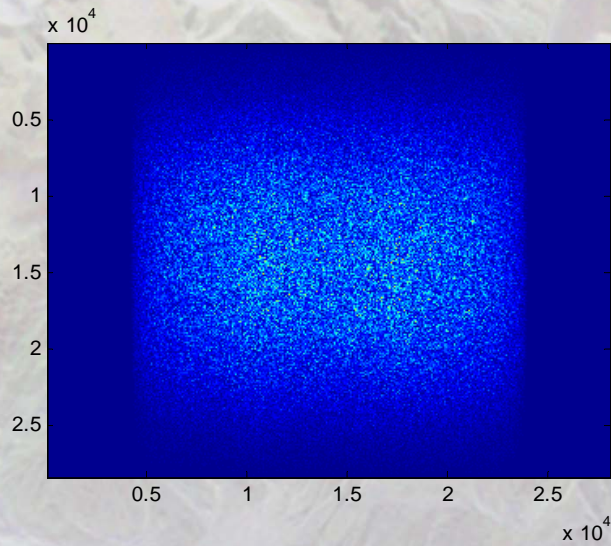
Focused SAR Image



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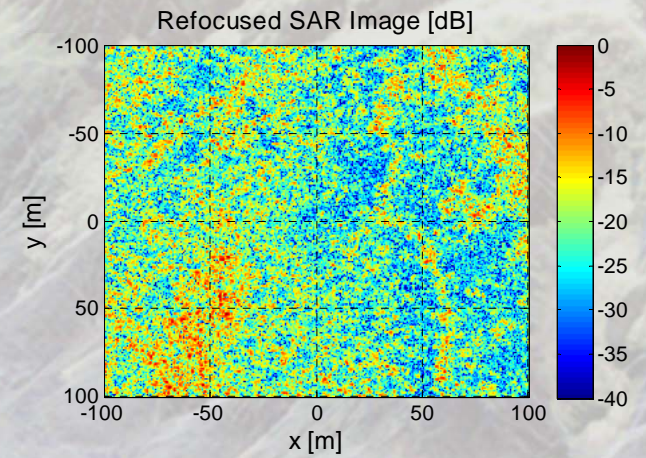
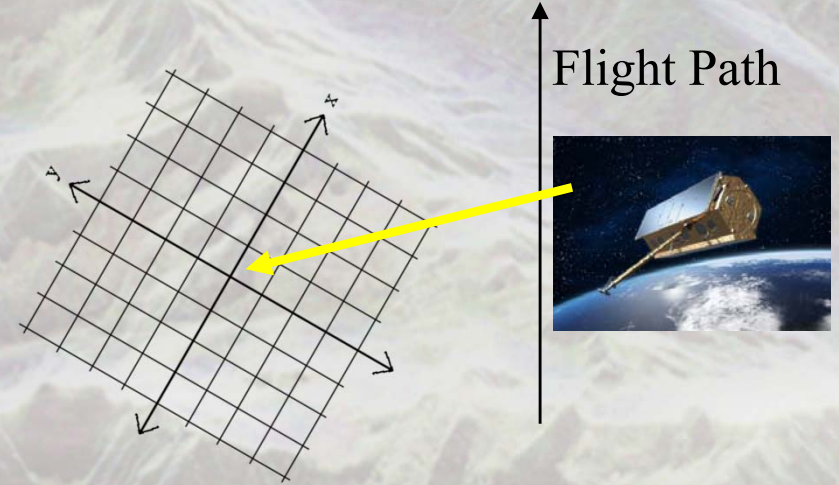
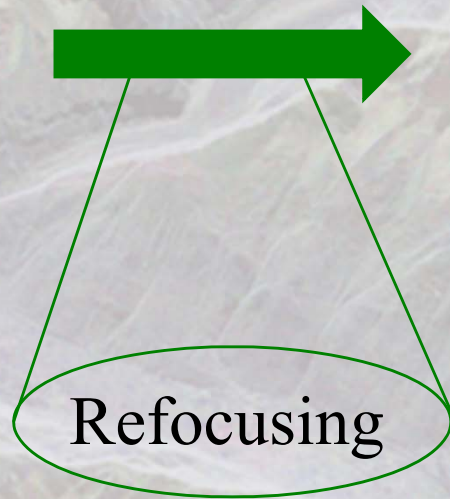
# SAR Image Refocusing



RAW data



New grid

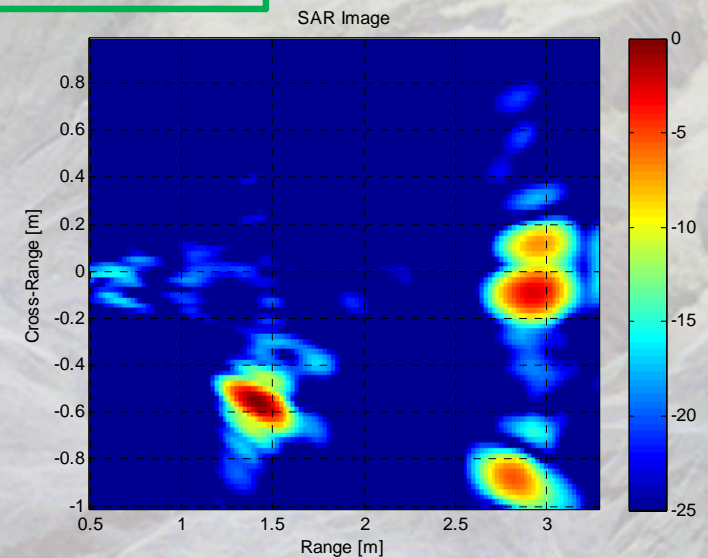
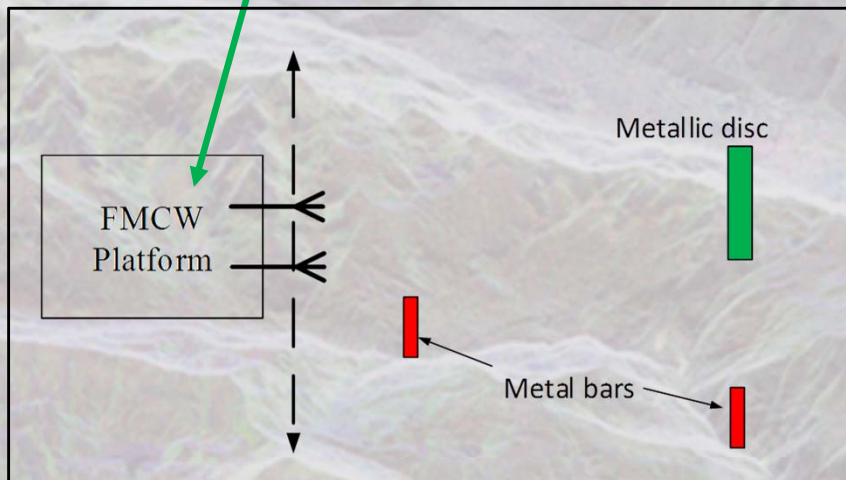
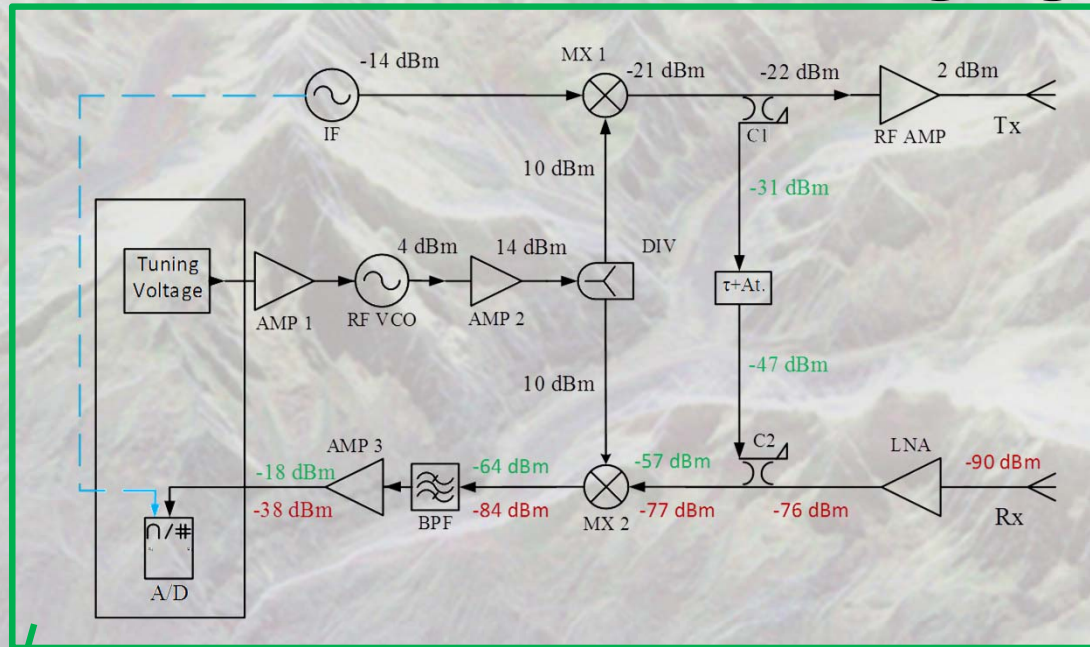


Refocused SAR Image on a specific grid.





# X-band Ground-based SAR Imaging System<sup>1</sup>

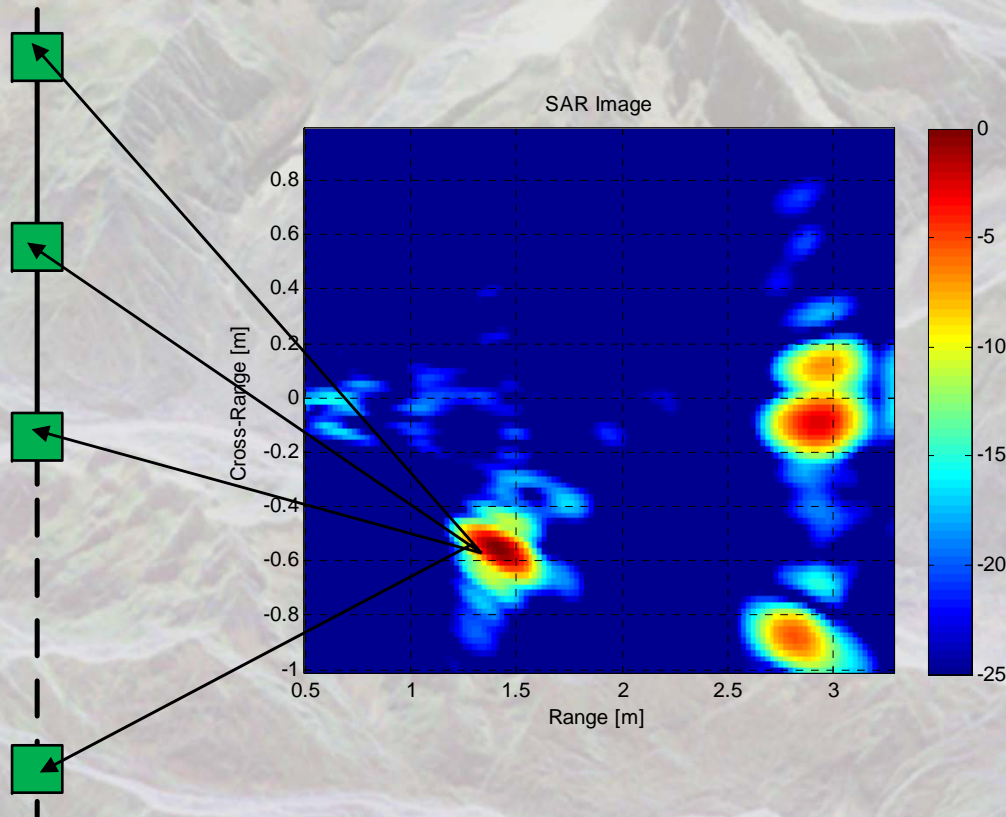


<sup>1</sup>Andrei Anghel, Gabriel Vasile, Remus Cacoveanu, Cornel Ioana, Silviu Ciochina, "Short-Range Wideband FMCW radar for millimetric displacements measurement", submitted to *IEEE Transactions on Geoscience and Remote Sensing*.



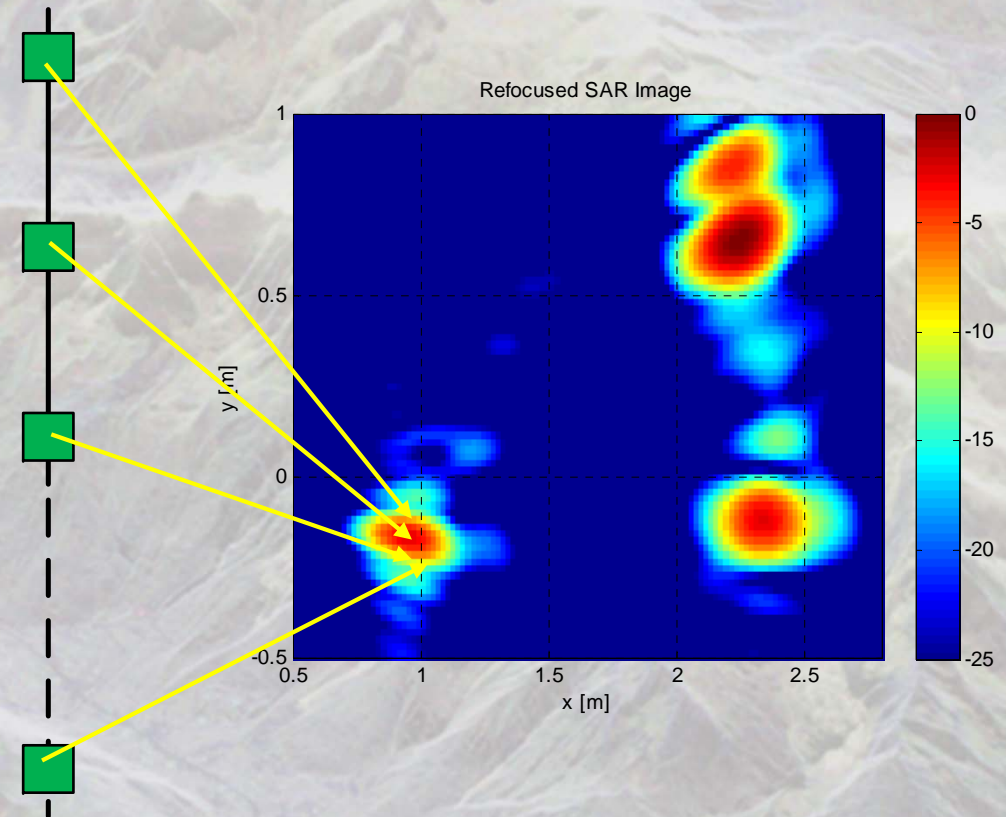
# Ground-based SAR Images Refocusing (1)

## Defocusing



Computing the response from each pixel on the synthetic aperture elements.

## Refocusing on a different grid

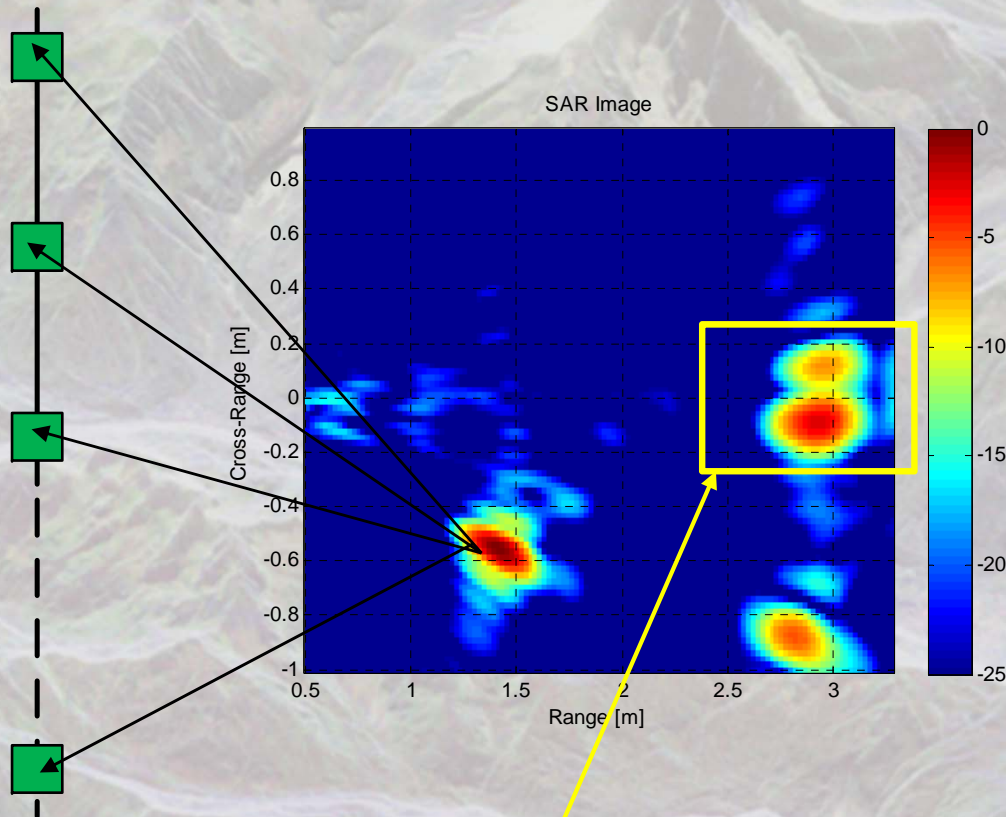


Applying the back-projection algorithm on the de-chirped raw data (the defocused image).



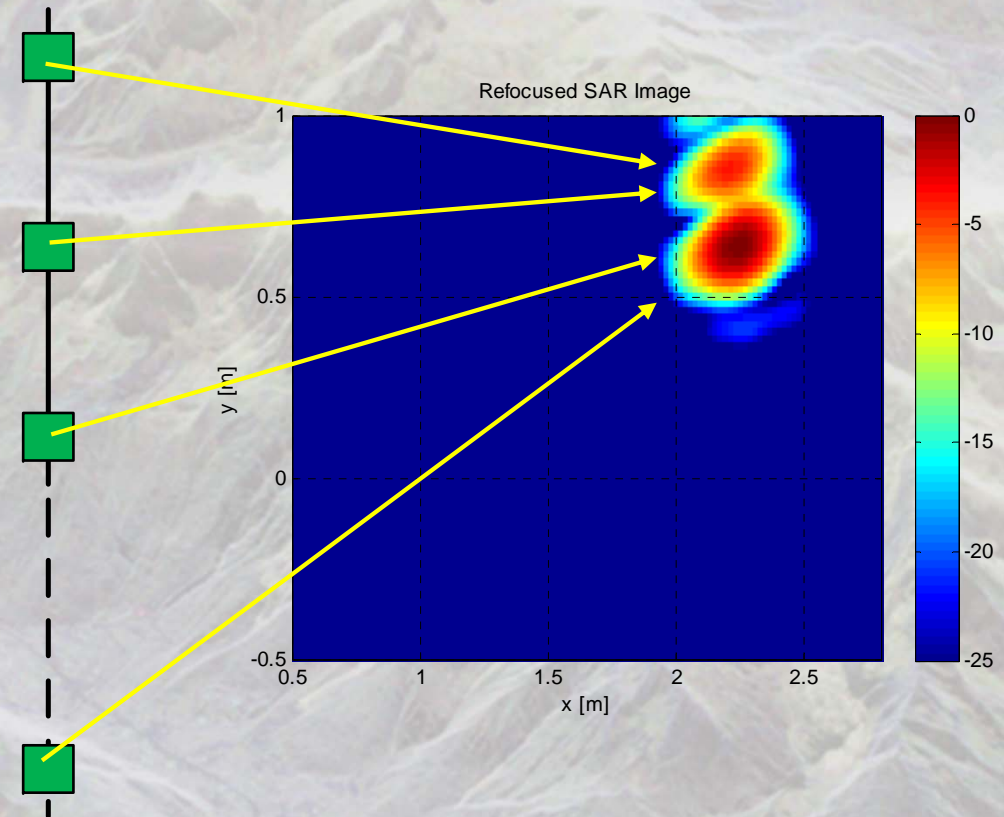
# Ground-based SAR Images Refocusing (2)

## Defocusing



Selecting only a certain target from the initial image (using a binary mask).

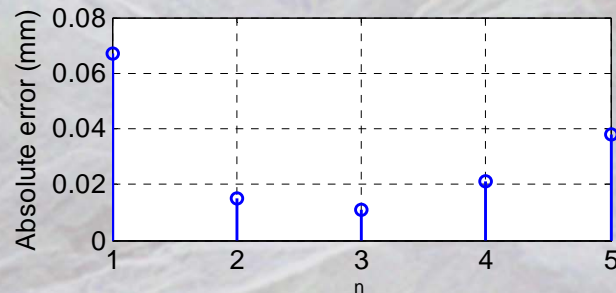
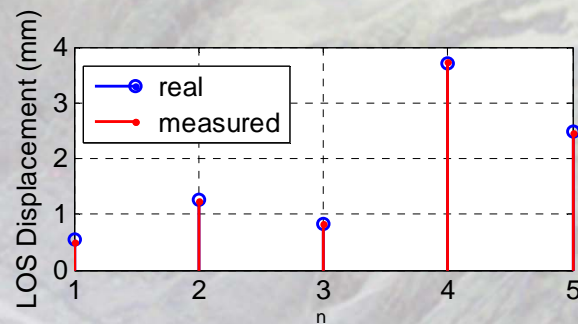
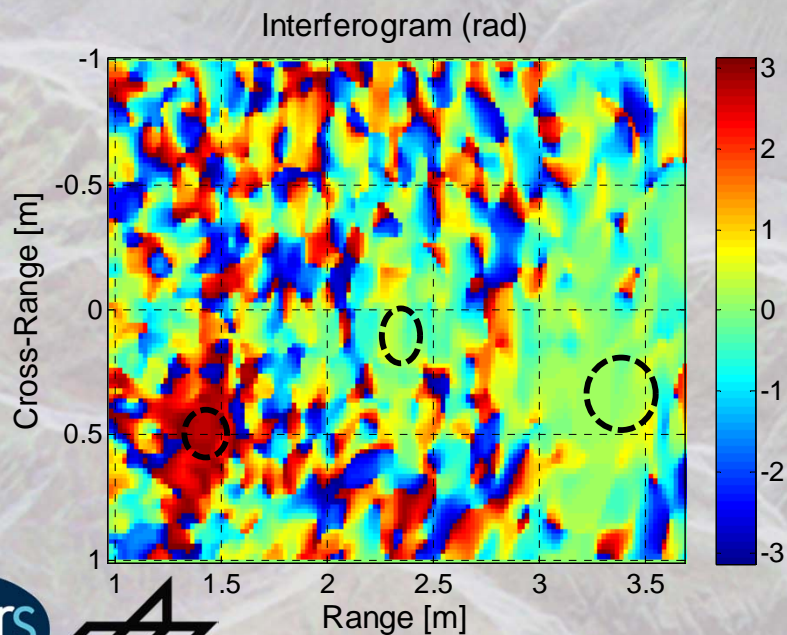
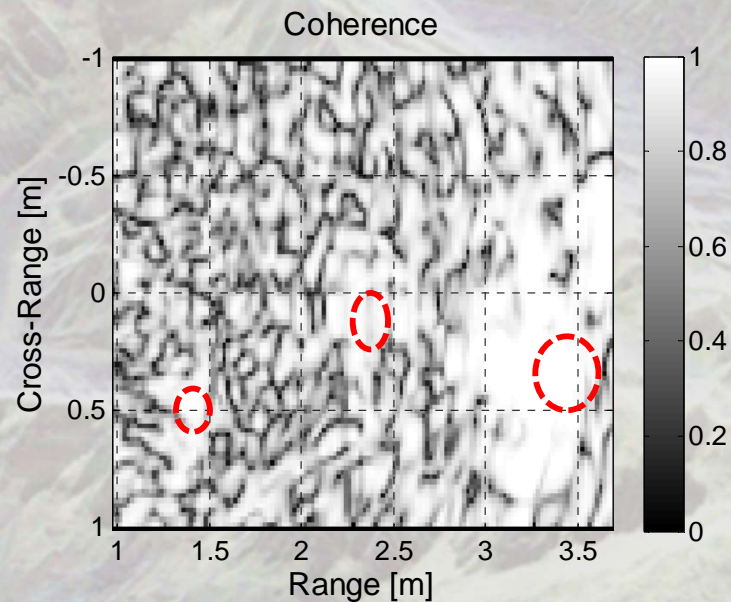
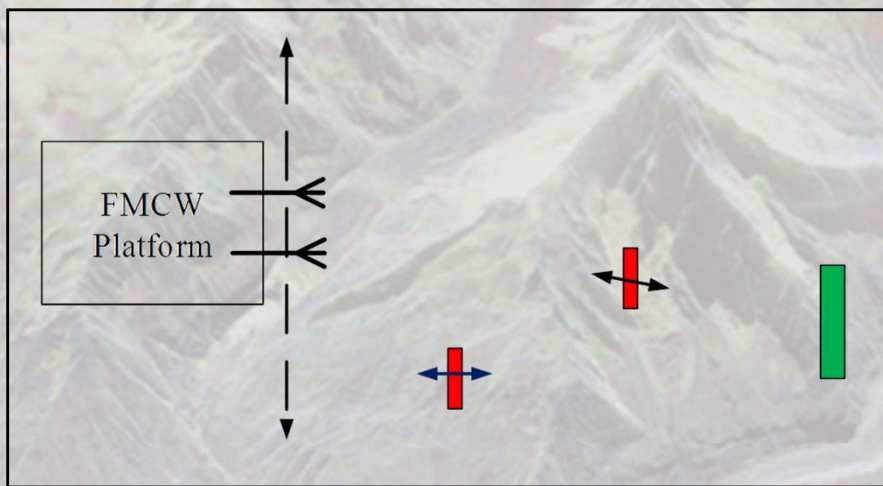
## Partial Refocusing on a different grid



Applying the back-projection algorithm on the de-chirped raw data (the defocused image).

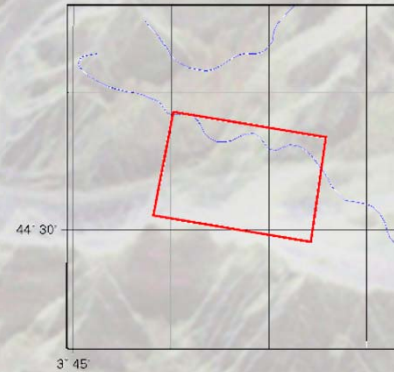
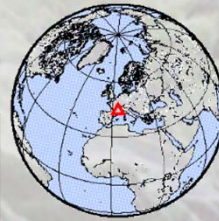
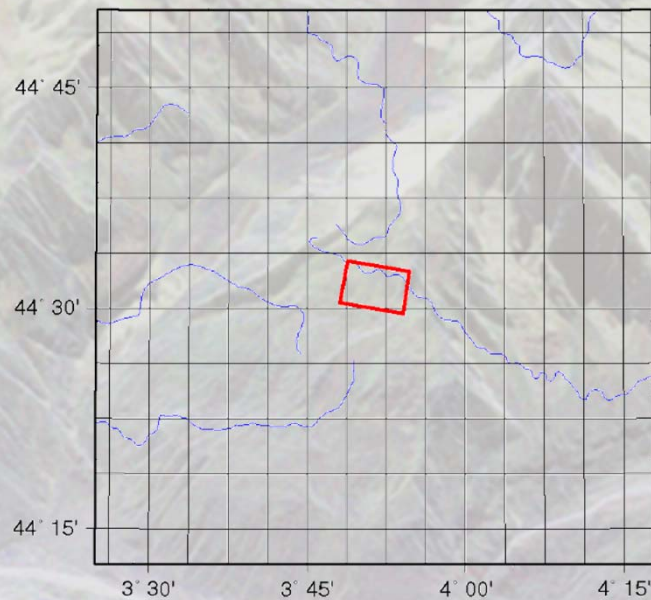


# Ground-based SAR Refocused Images Interferogram





# Spotlight High-Resolution TerraSAR-X images (300 MHz)



acquisition mode : "HS" / "spot\_056" / "VV" / "R"

product type : "SSC" /

start time UTC : "2012-05-27T05:53:32.875345"

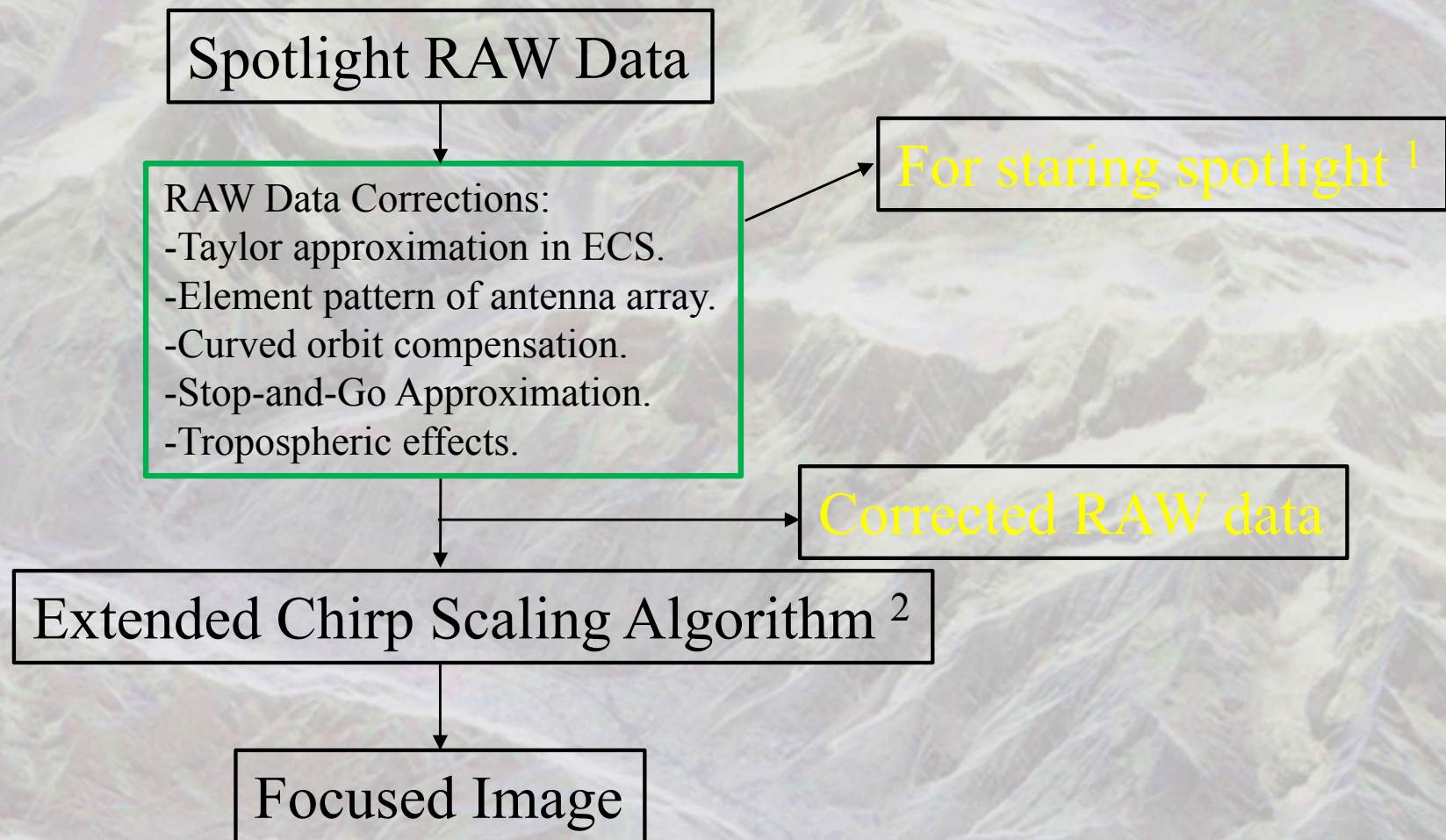
stop time UTC : "2012-05-27T05:53:33.636209"

orbit cycle / no. / dir. : 165 / 27451 / 63 / "D"





# Focused TerraSAR-X spotlight image

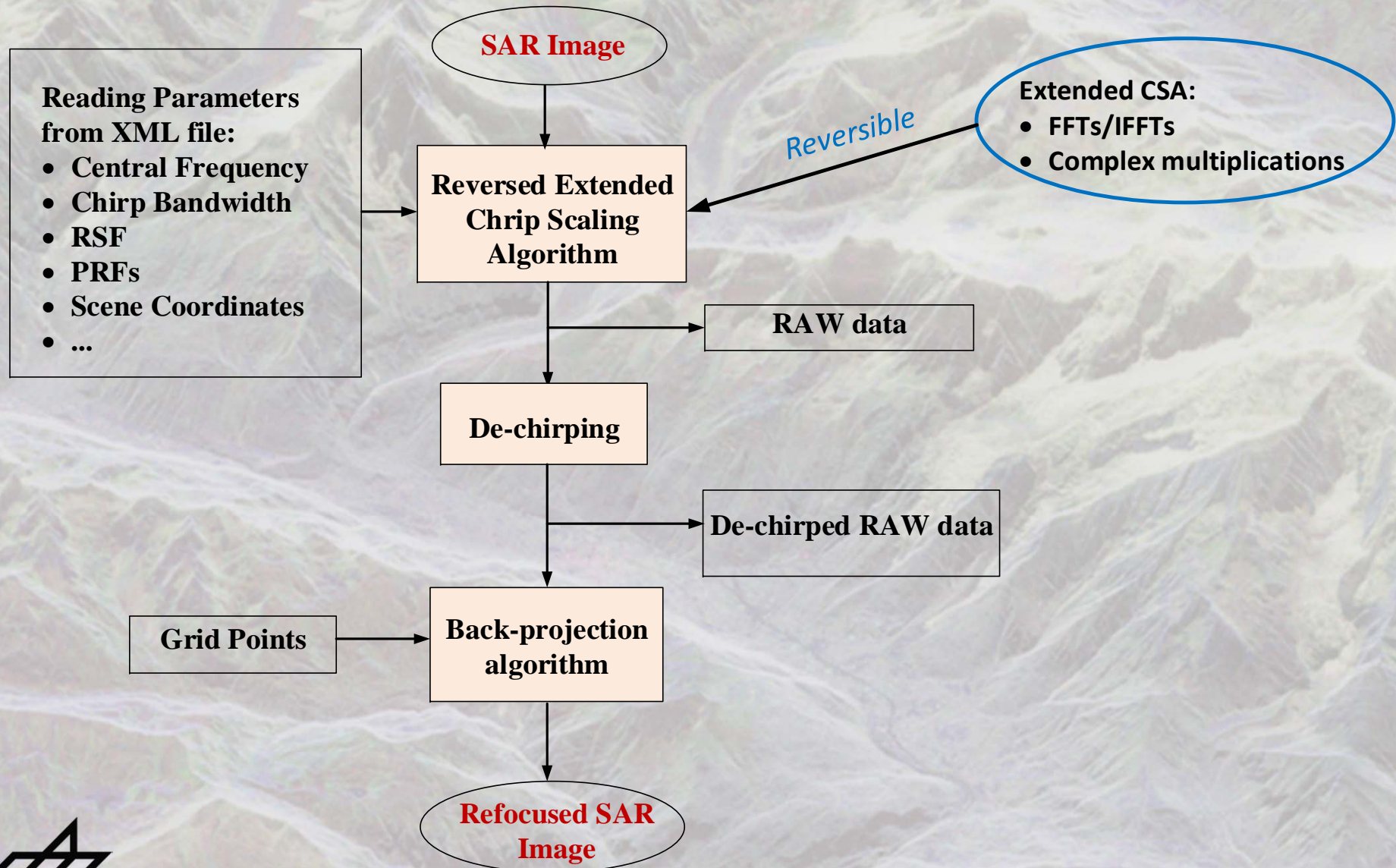


<sup>1</sup>Pau Prats-Iraola, Rolf Scheiber, Marc Rodriguez-Cassola, Steffen Wollstadt, Josef Mittermayer, Benjamin Brautigam, Marco Schwerdt, Andreas Reigber and Alberto Moreira, "High Precision SAR Focusing of TerraSAR-X Experimental Staring Spotlight Data", in *Proc. IGARSS'12*, Munich, Germany, pp. 3576-3579.

<sup>2</sup>Alberto Moreira, Josef Mittermayer and Rolf Scheiber, "Extended Chirp Scaling Algorithm for Air- and Spaceborne SAR Data Processing in Stripmap and ScanSAR", *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 34, No. 5, Sept. 1996, pp. 1123-1136.



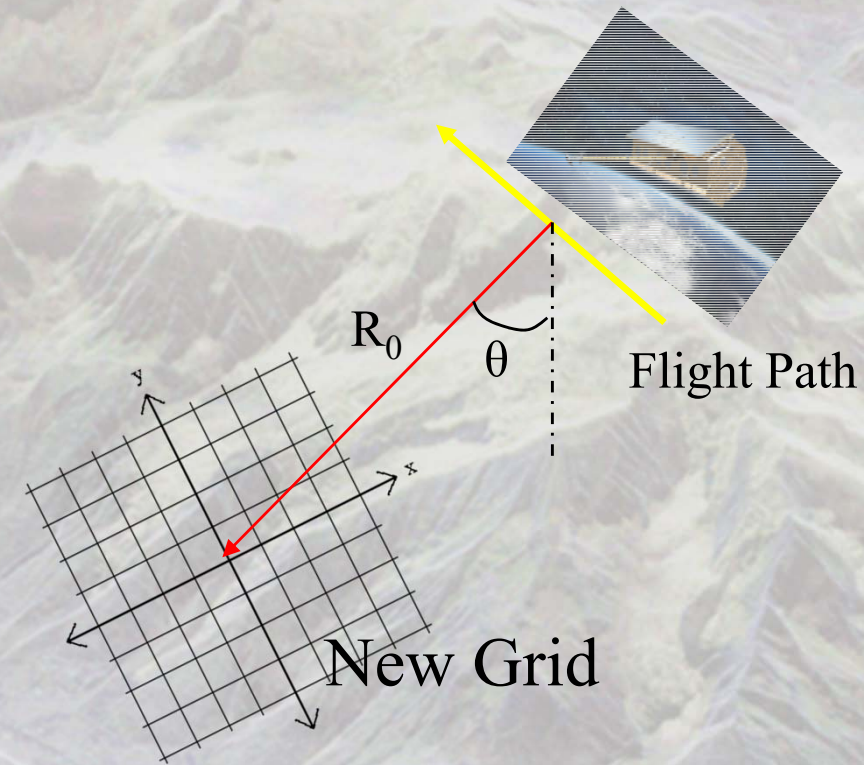
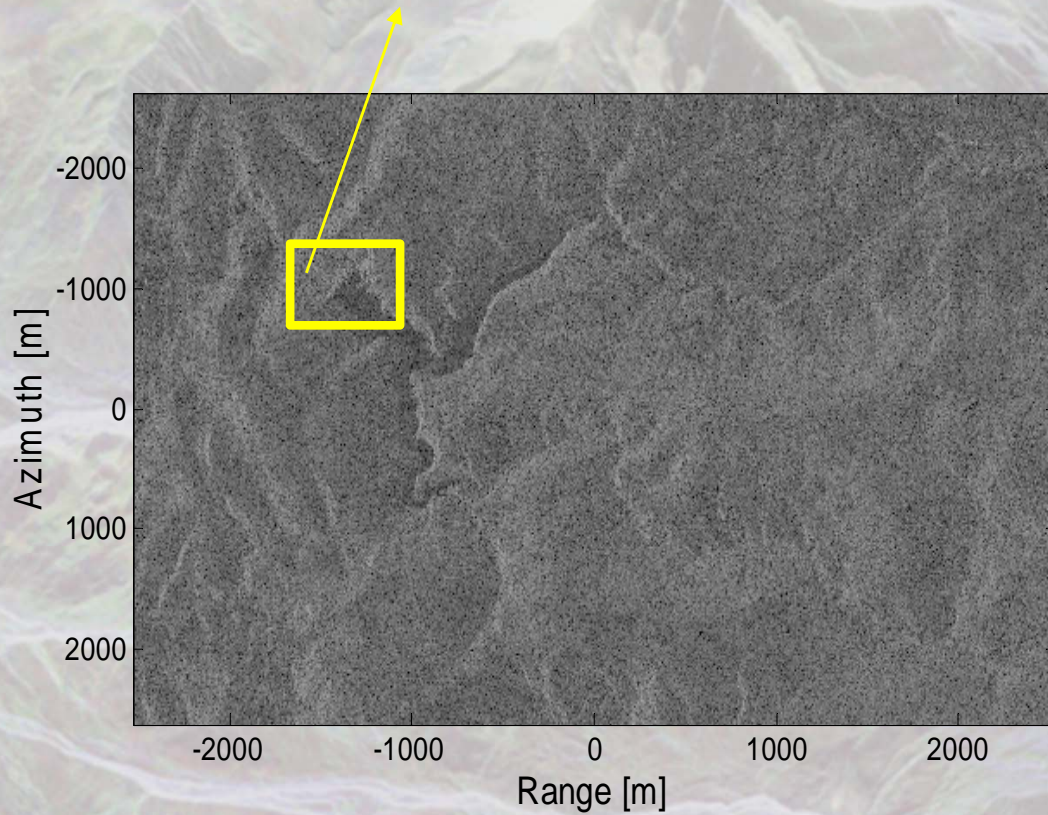
# Refocusing TerraSAR-X images





# Refocusing TerraSAR-X images : First Results (1)

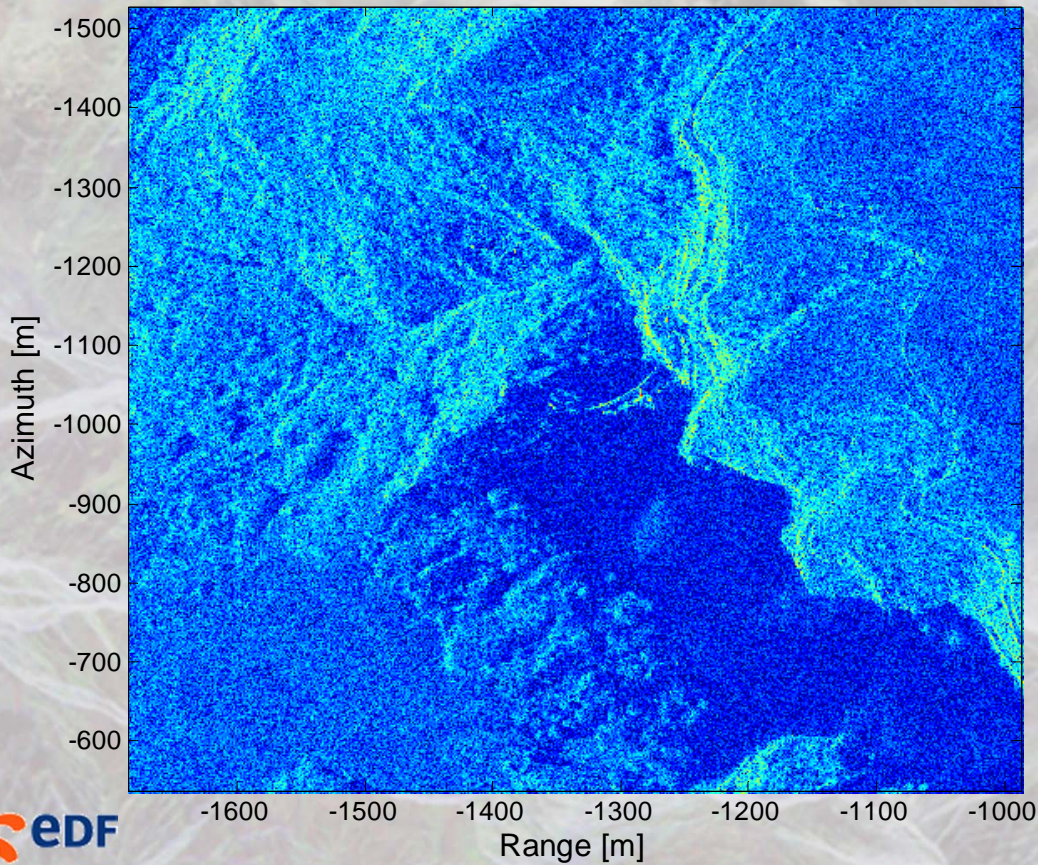
Refocused Area



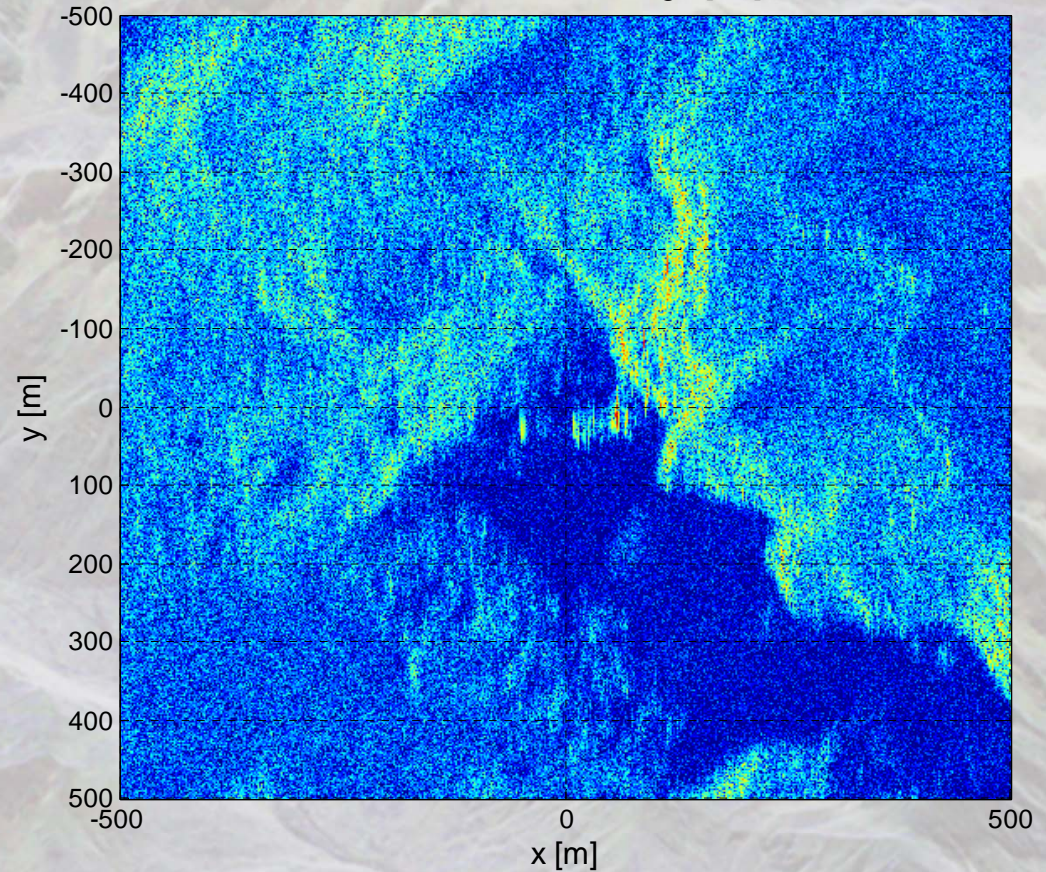


# Refocusing TerraSAR-X images : First Results (2)

Initial Image [dB]



Refocused SAR Image [dB]

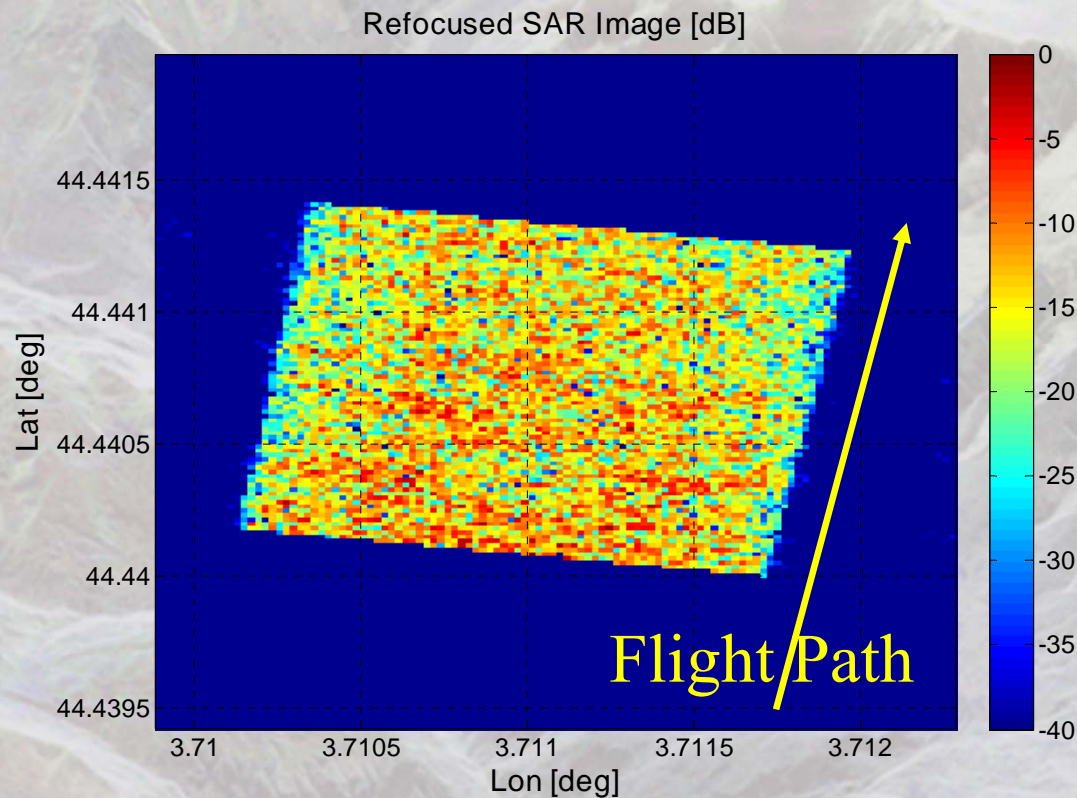
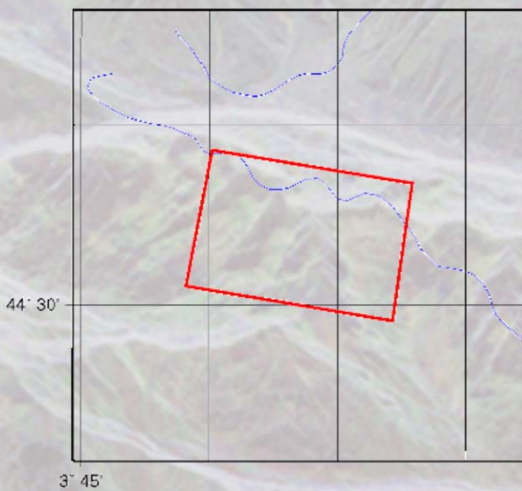


40 dB dynamic range



# Further Research (1)

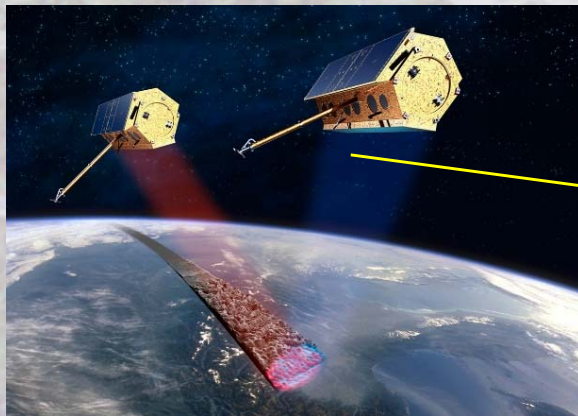
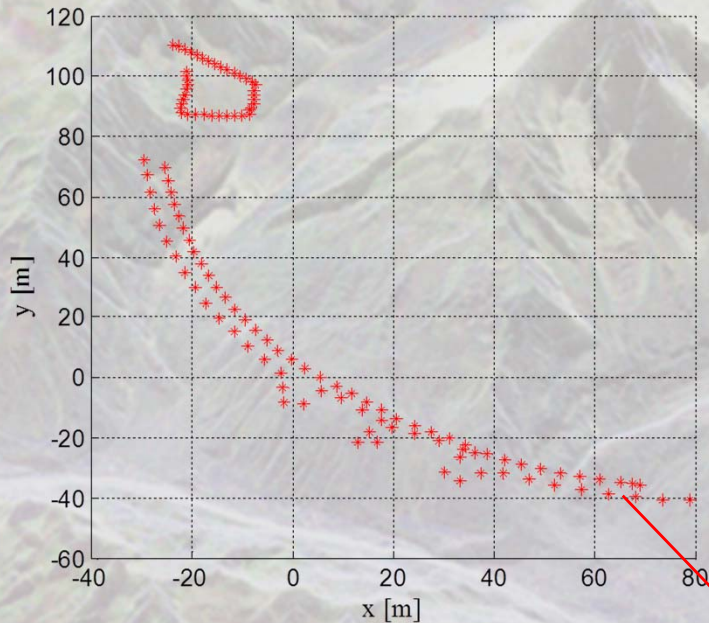
- The resolution issues in the refocusing process.
- Refocus the raw data in latitude-longitude geometry using a GPS-measured grid.
- Employ interferometric processing on refocused images.





# Further research (2): Puylaurent dam displacements measurement with TanDEM-X

GPS-measured points on the dam's ridge.



Refocusing TanDEM-X images on the measured points.

Dam's ridge displacements monitoring.





**Thanks for your attention !!!**

**Questions ?  
Suggestions ?**



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