OUTLINE

I. Radar imaging - Spatial resolution
II. Polarization - Polarimetry
III. Radar response sensitivity
IV. Relief effects
V. Speckle and Filtering

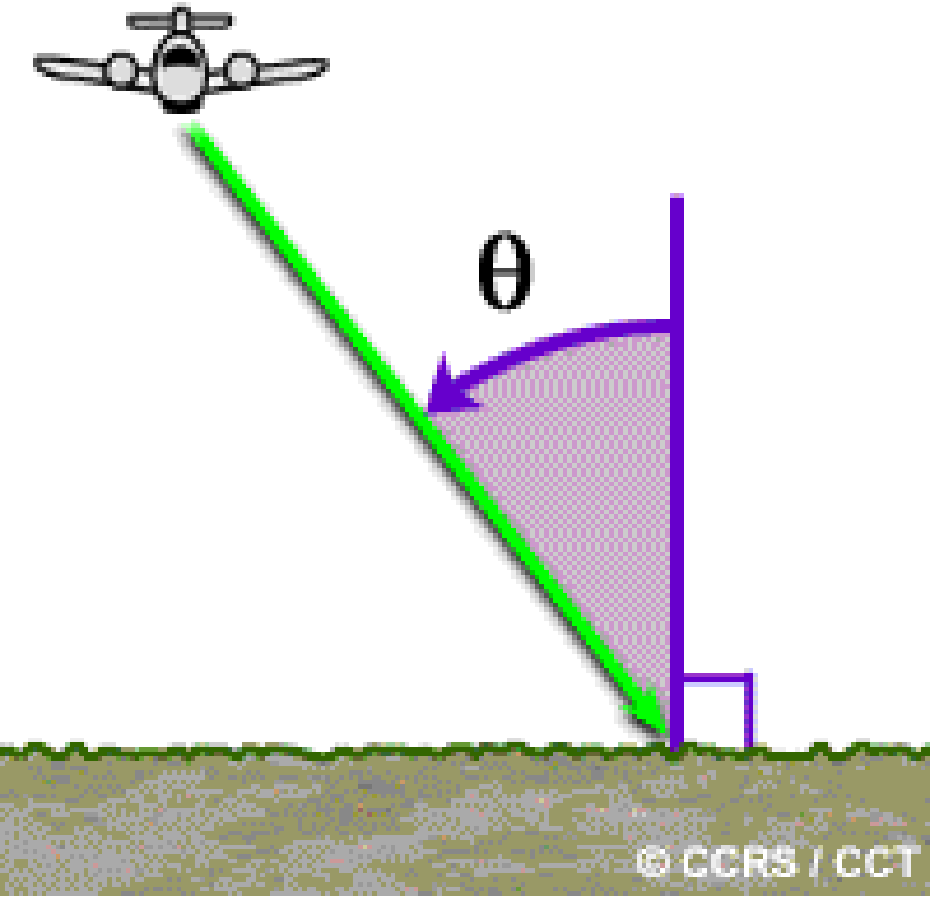
Université Gustave Eiffel

LaSTIG
Laboratoire des Sciences et Technologies de l'Information Géographique

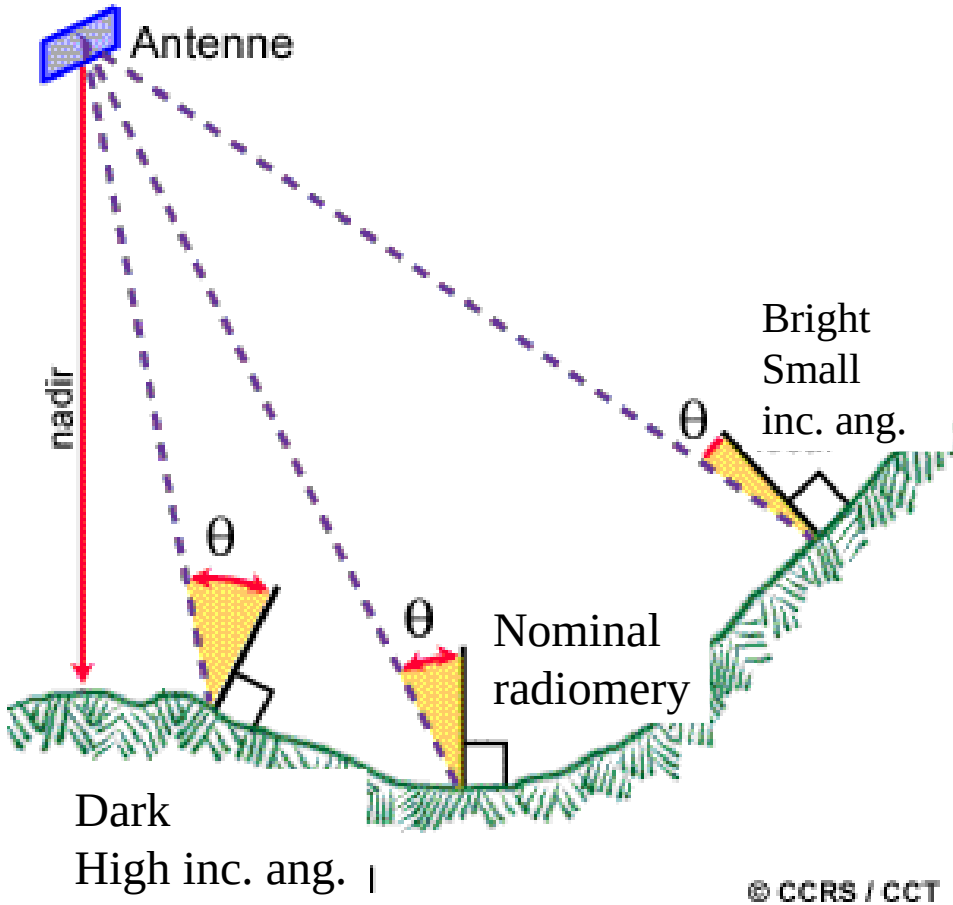
Relief effects

Acquisition incidence angle

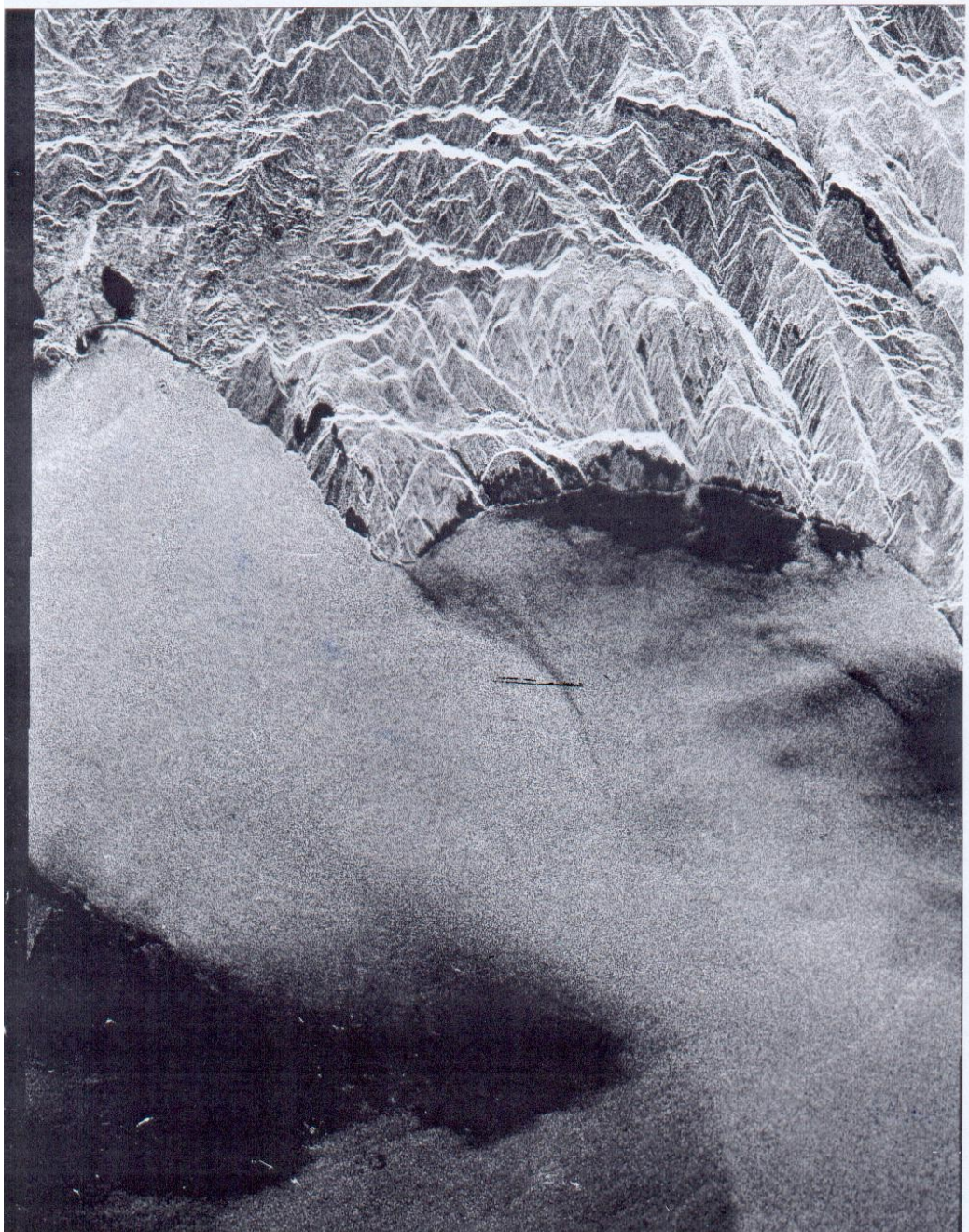
Incidence on flat terrain



Local ncidence on relief

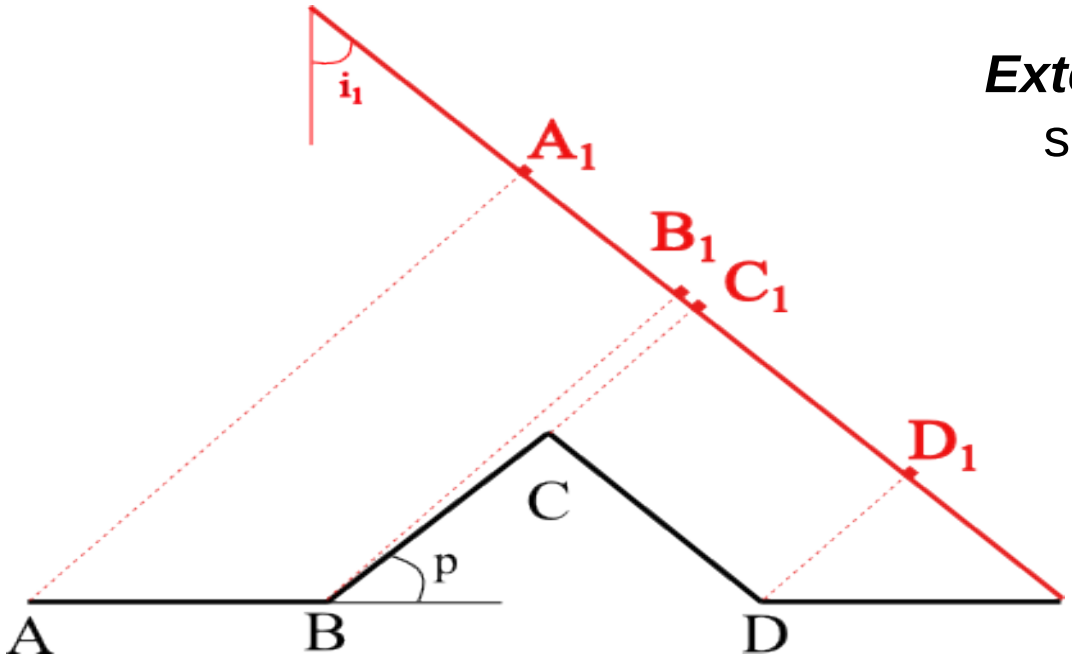


Relief effects



Relief effects

Echoes are **ranged** according to
Antenna – target distance



Foreshorting
slopes facing the radar

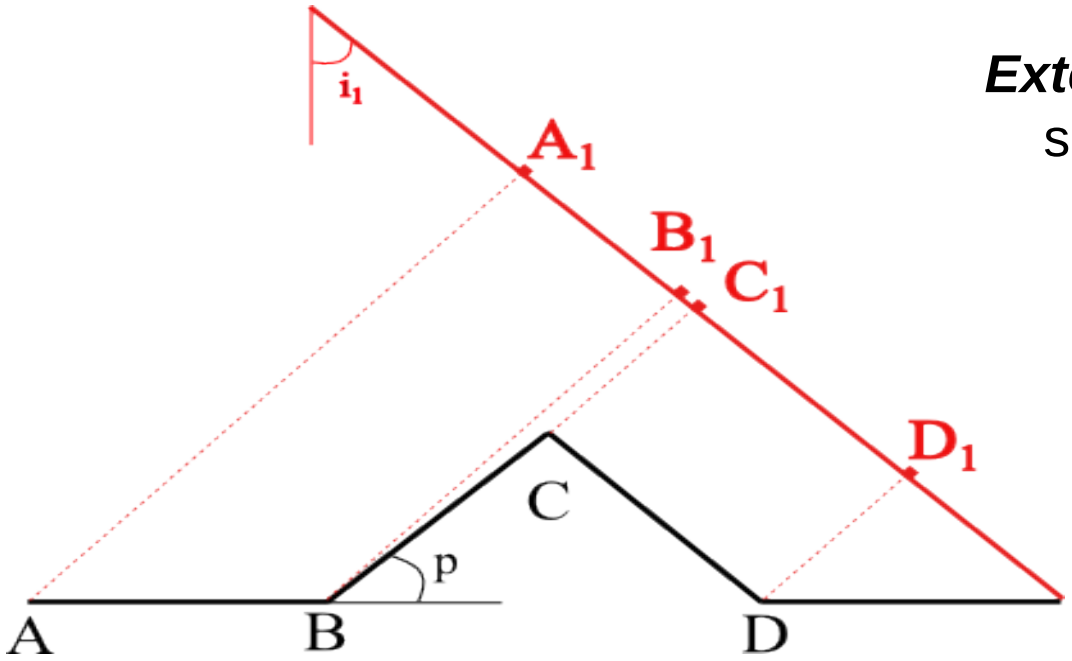
Extension
slopes backward to the radar

Relief effects

Echoes are **ranged** according to **Antenna – target** distance

Foreshorting
slopes facing the radar

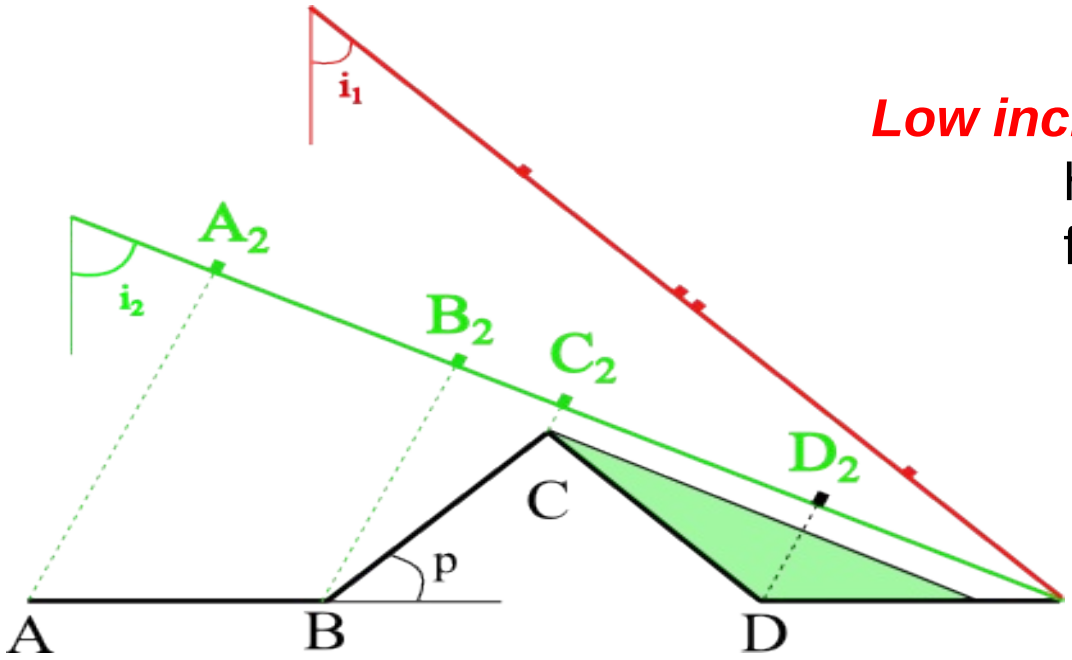
Extension
slopes backward to the radar



$A_1B_1=AB\ \sin(i_1)$ $B_1C_1=BC\ \sin(i_1- p);$ $C_1D_1=CD\ \sin(i_1+ p)$

Relief effects

Echoes are **ranged** according to
Antenna – target distance



Low incidences angle

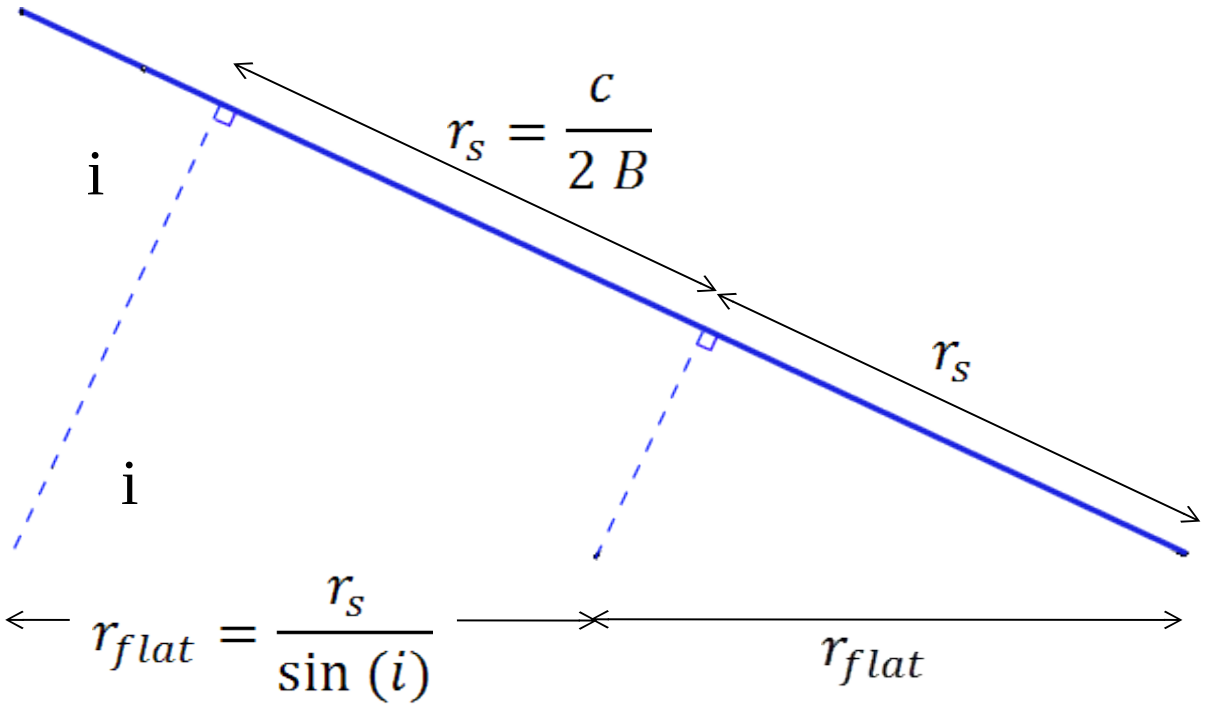
high geometrical distorsions
few shaddows

High incidence angle

low geometrical distorsions
lot of shadows

Relief effects

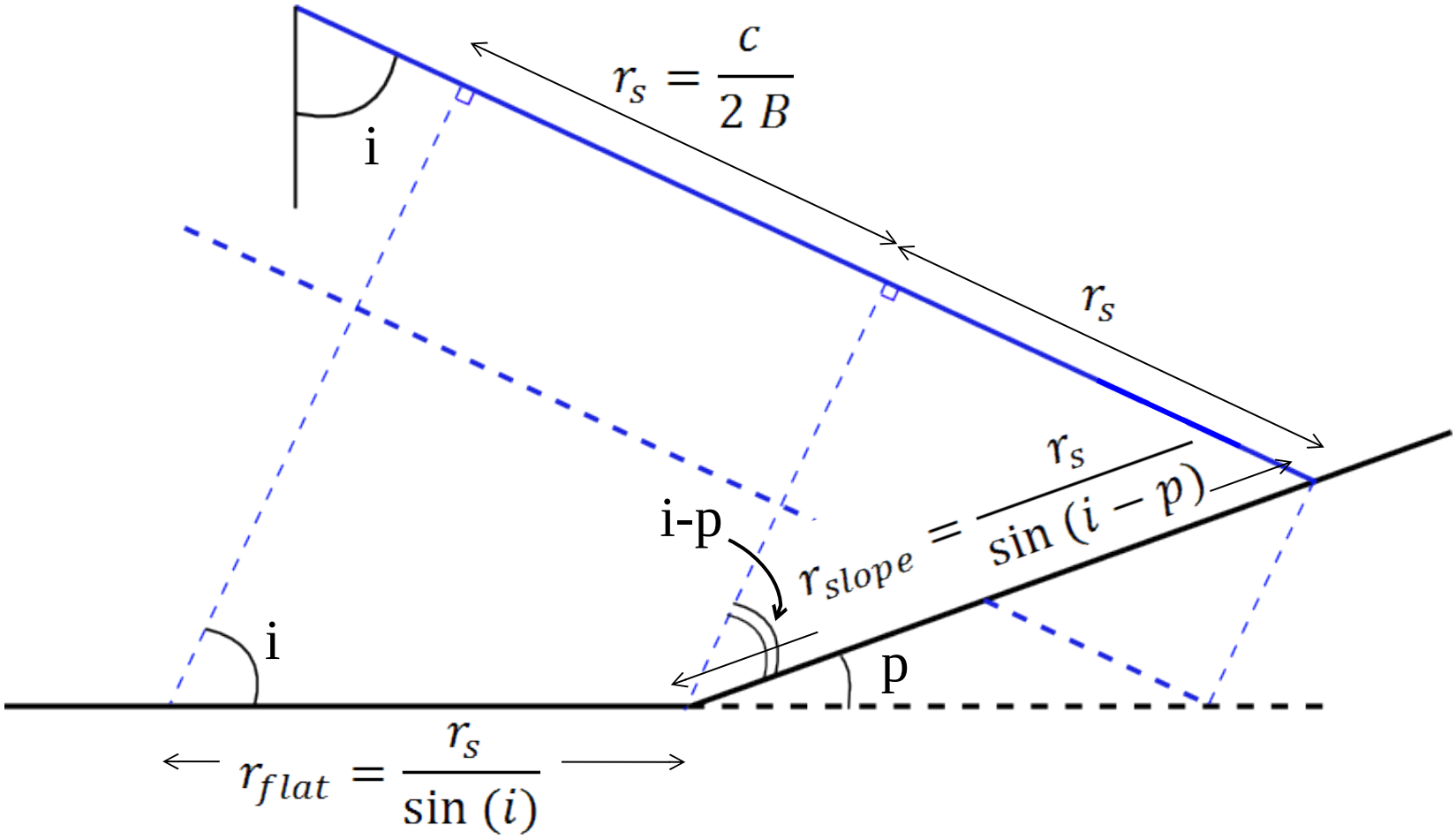
Range resolution

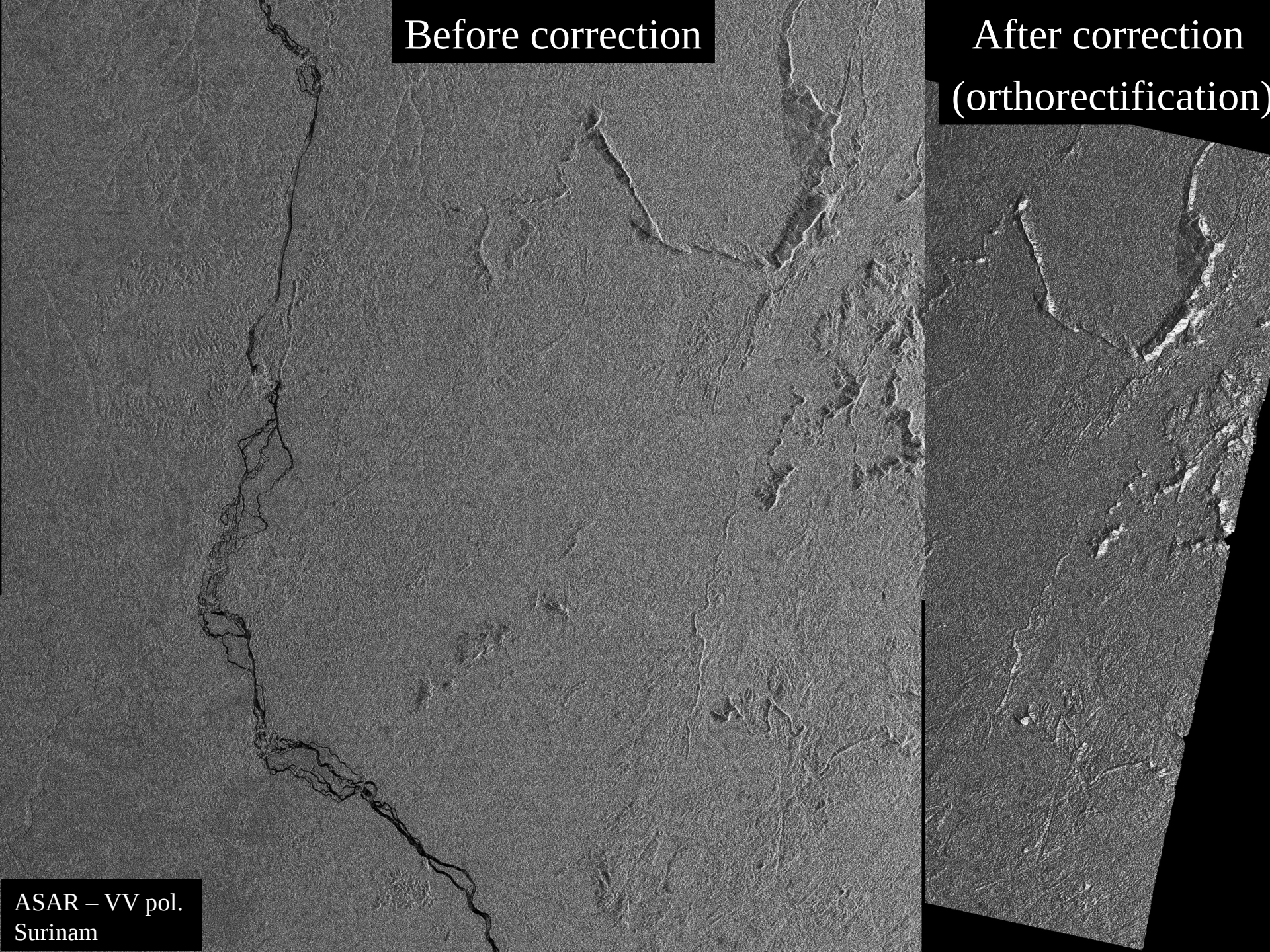


Relief effects

Range resolution

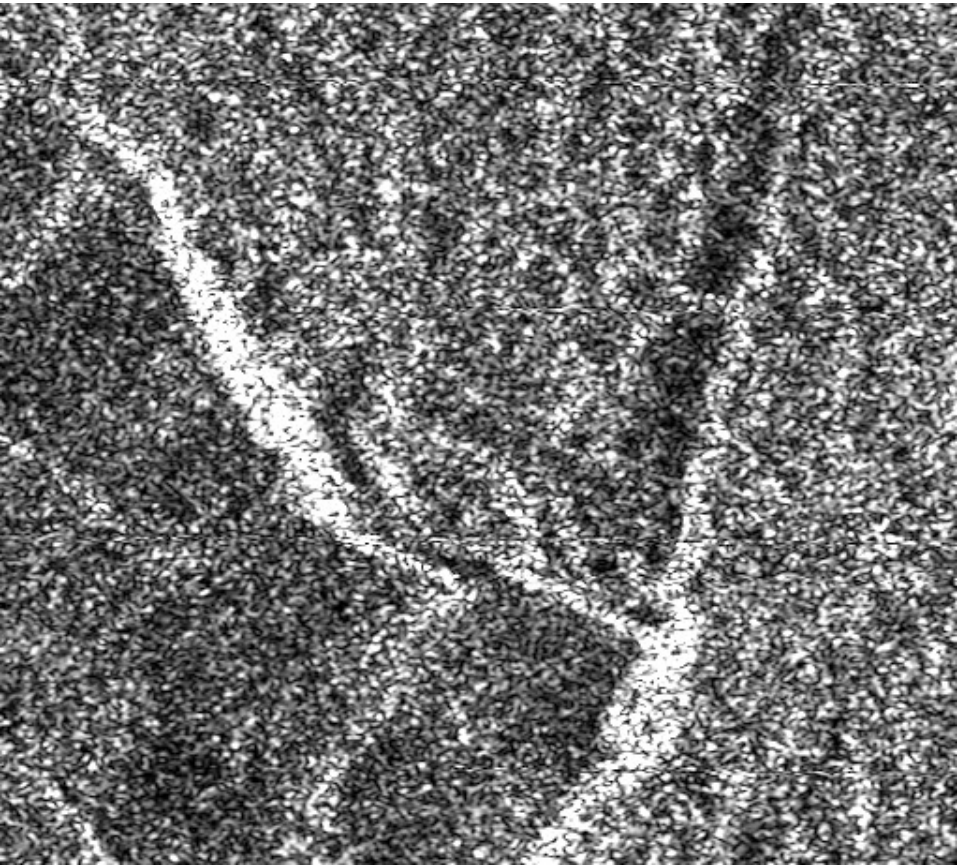
$$r_{slope} = r_{flat} \frac{\sin(i)}{\sin(i-p)}$$



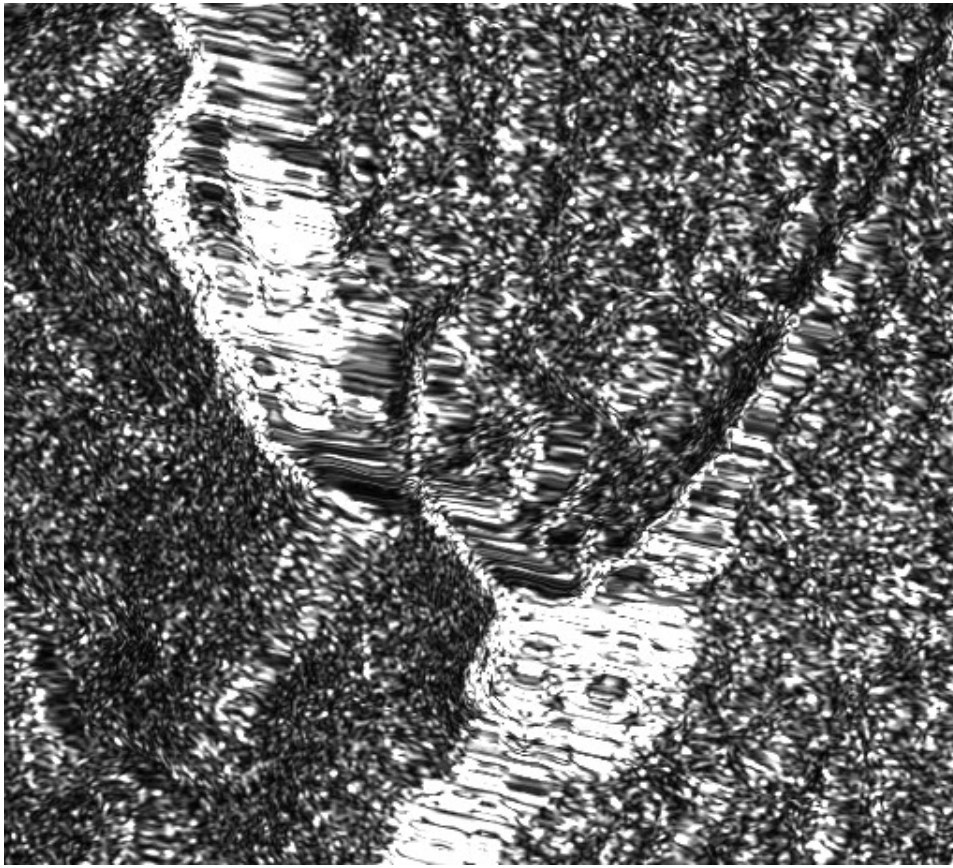

Before correction
After correction
(orthorectification)
ASAR – VV pol.
Surinam

Relief effects

Before correction

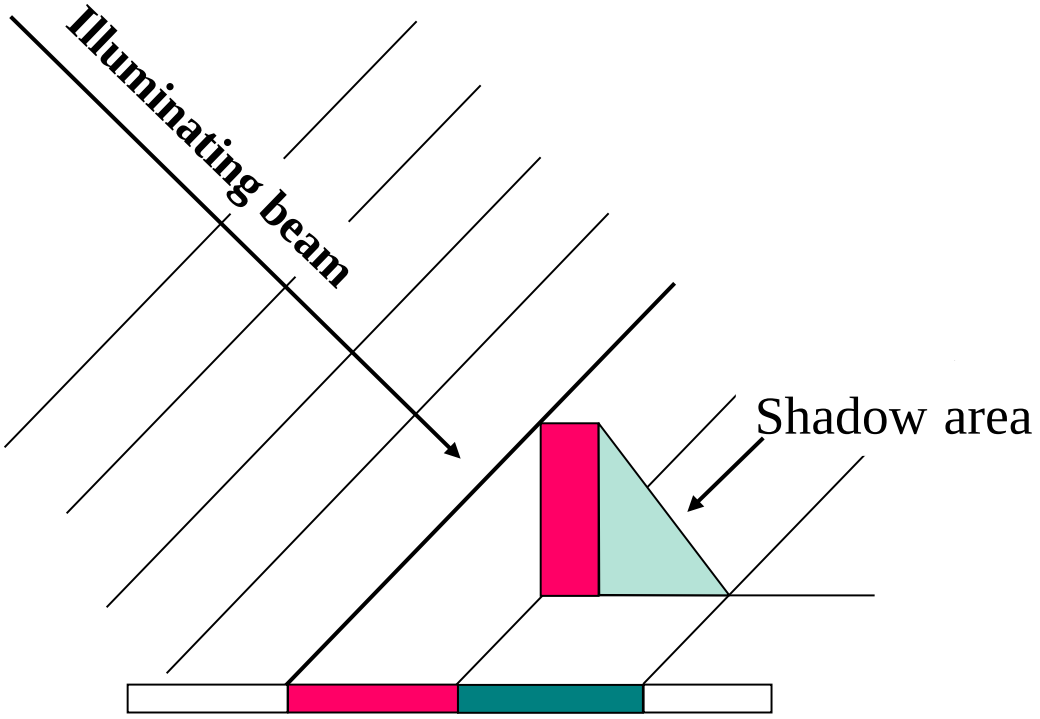


After correction
(Orthorectification)



Relief effects

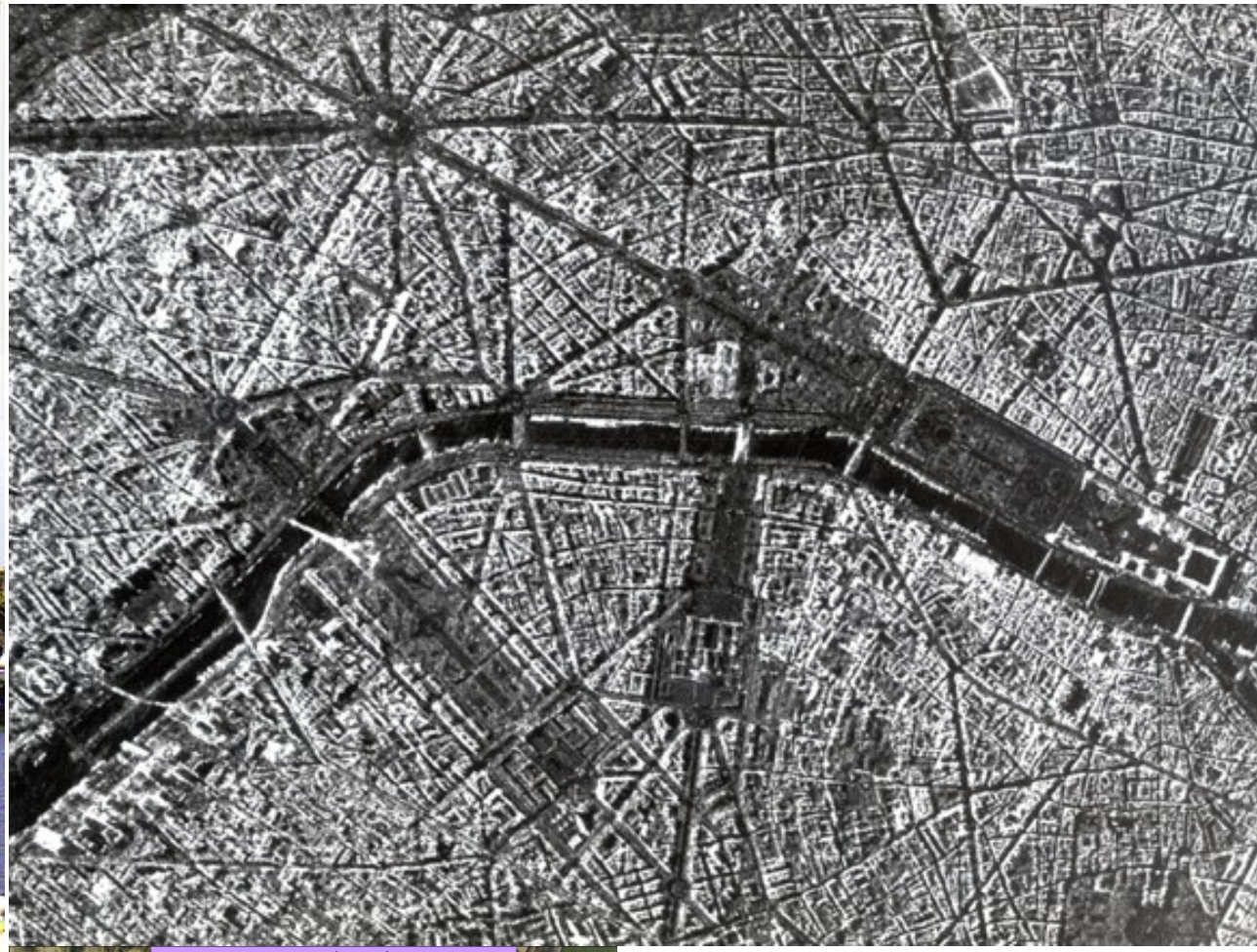
Layover effect



from CNES

Image Line generated

H=300m

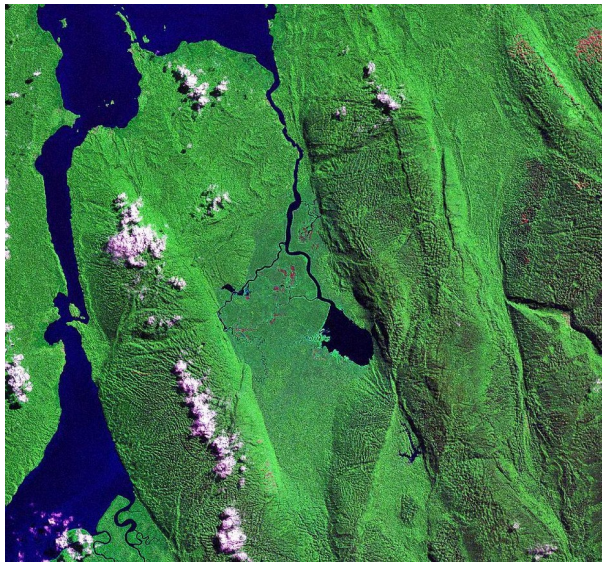


500 m

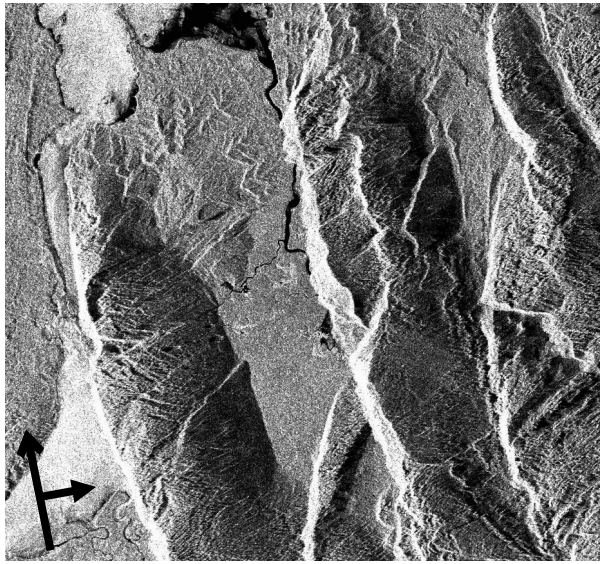
Relief effects

Exercice

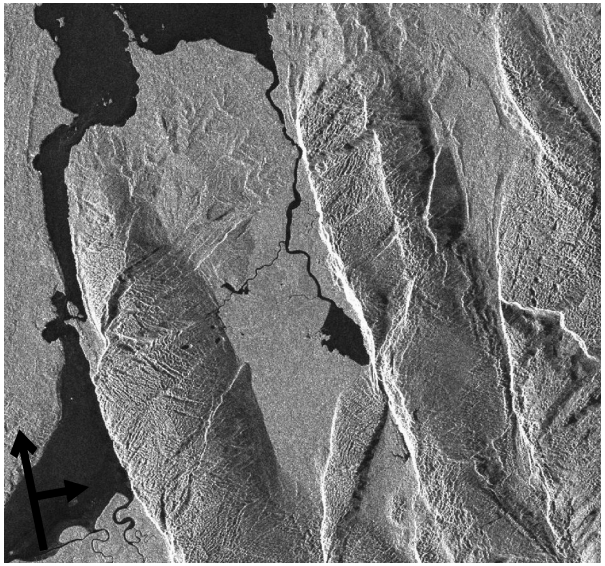
The distortions of radar satellite scenes are the consequence of geometric relationships between the radar pulse and the topography



Landsat 7 ETM+
ortho



ENVISAT-ASAR IS3
Low view angle: 28°

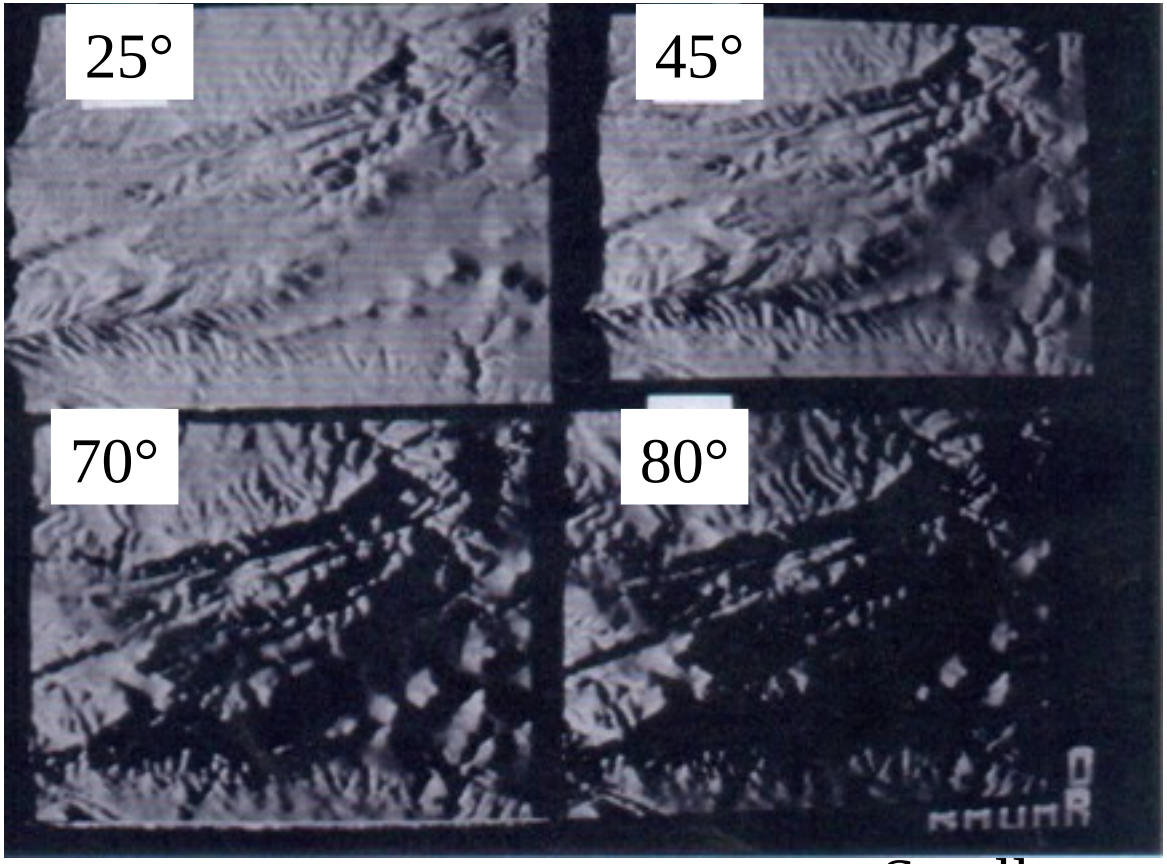


ENVISAT-ASAR IS7
High view angle 43°

Use geometric distortions of radar scenes to calculate the slope

Relief effects

Few shadows
High geom. distorsions



Small geom. Distorsions
Lot of shadows

Relief Effects

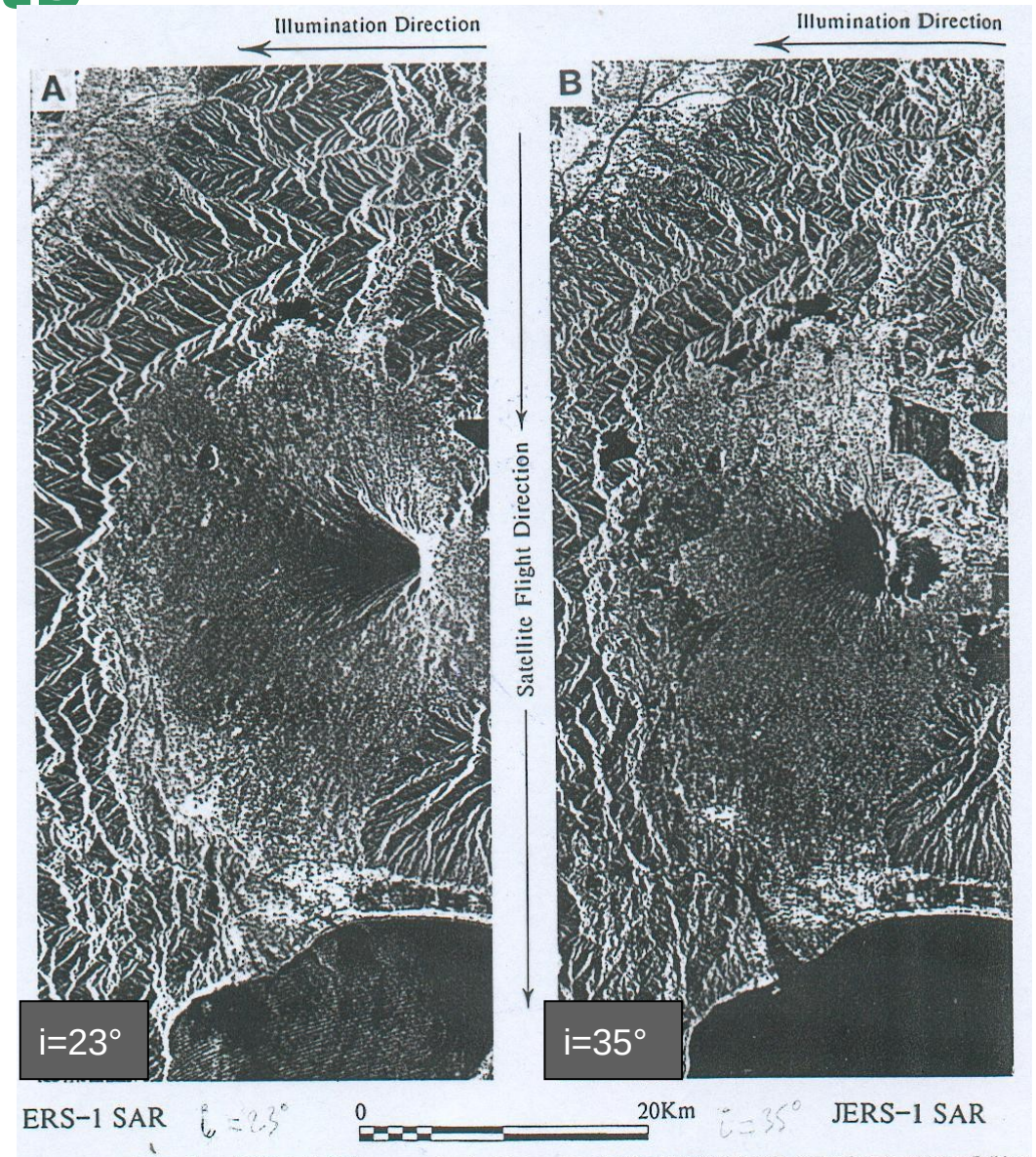
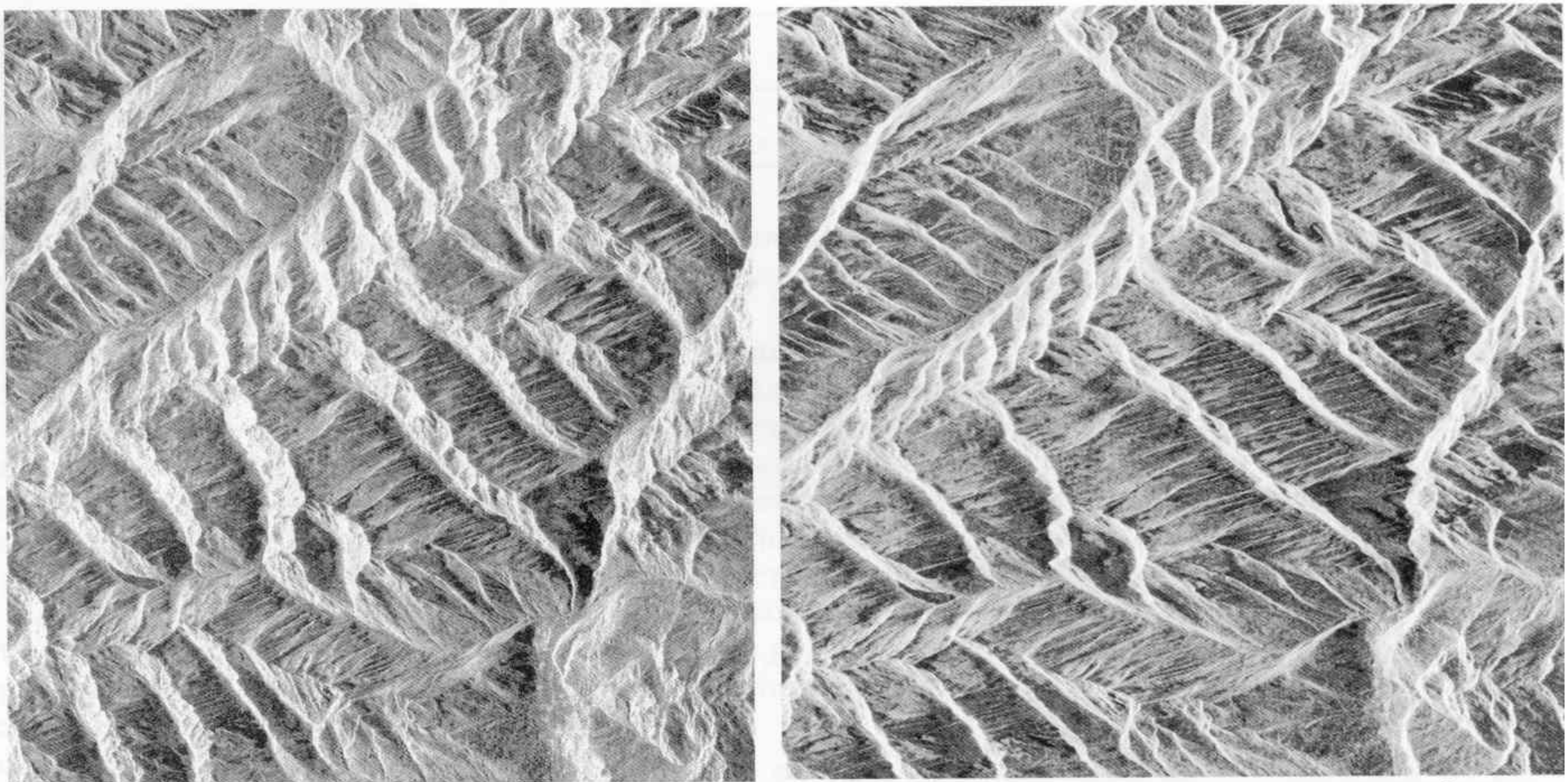


Figure 3.38 ERS-1 (a) and JERS-1 (b) SAR images of part of Japan, showing the volcano Mount Fuji. The fact that Mount Fuji is a nearly perfect cone with a circular summit crater serves to demonstrate the inappropriate depression angle of ERS-1 SAR by its apparently lying on its side. Many other rugged topographic features are also completely distorted by extreme layover. The JERS-1 image preserves the shape of the volcano, but still contains layover.

Relief Effects

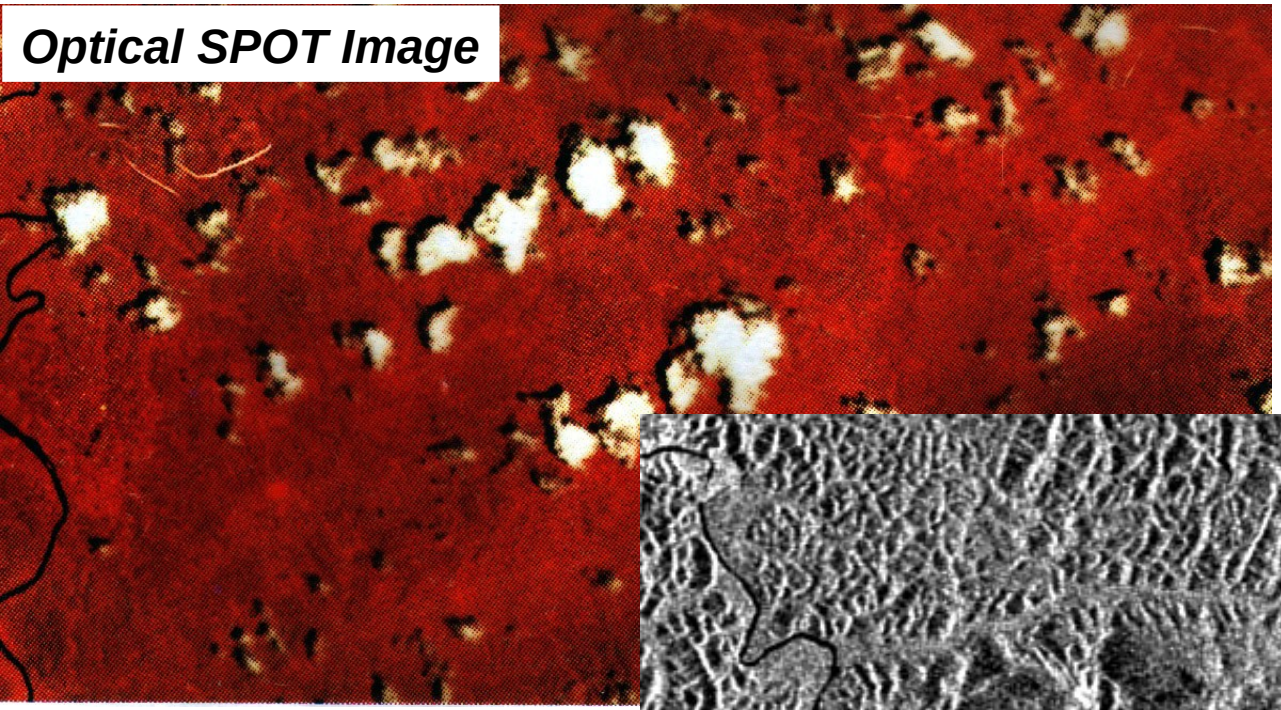


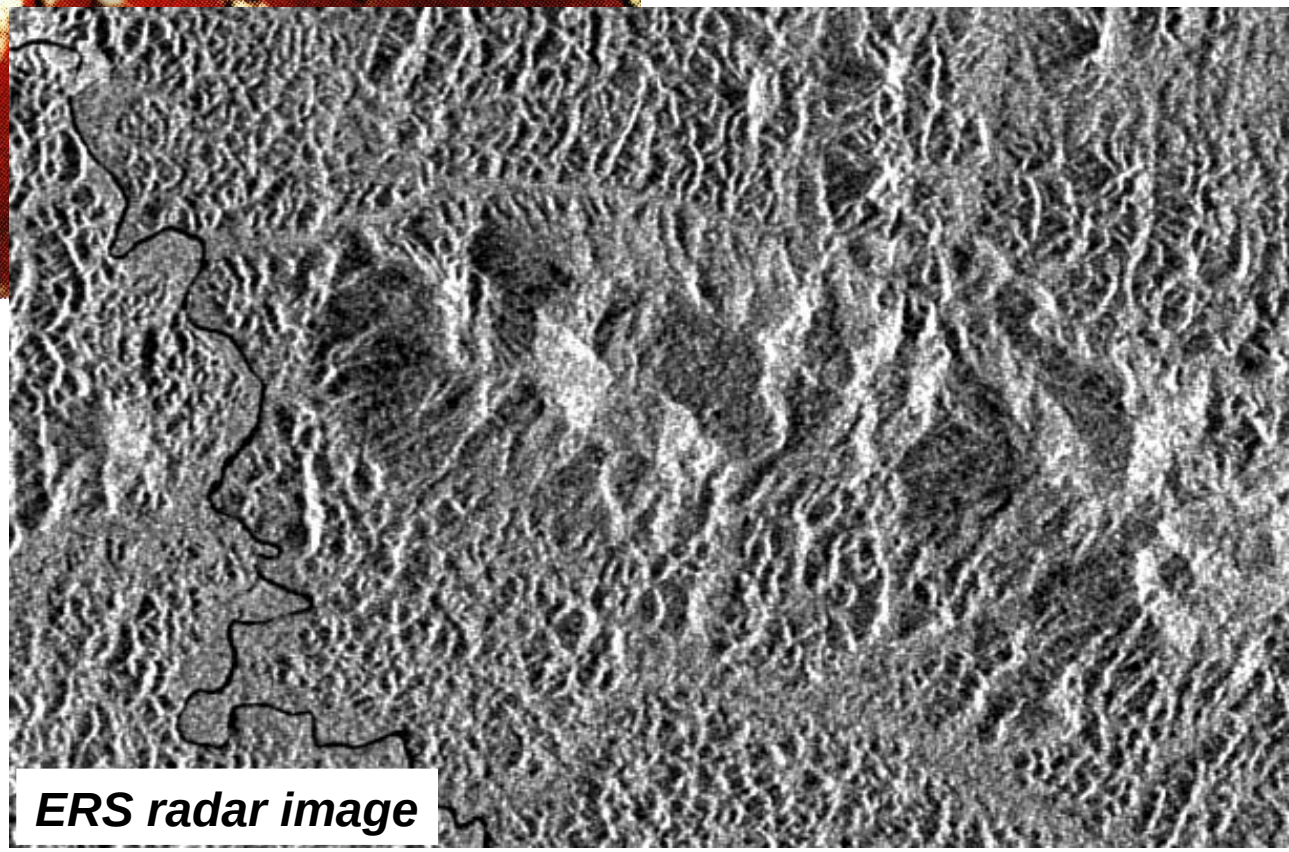
Flight Direction

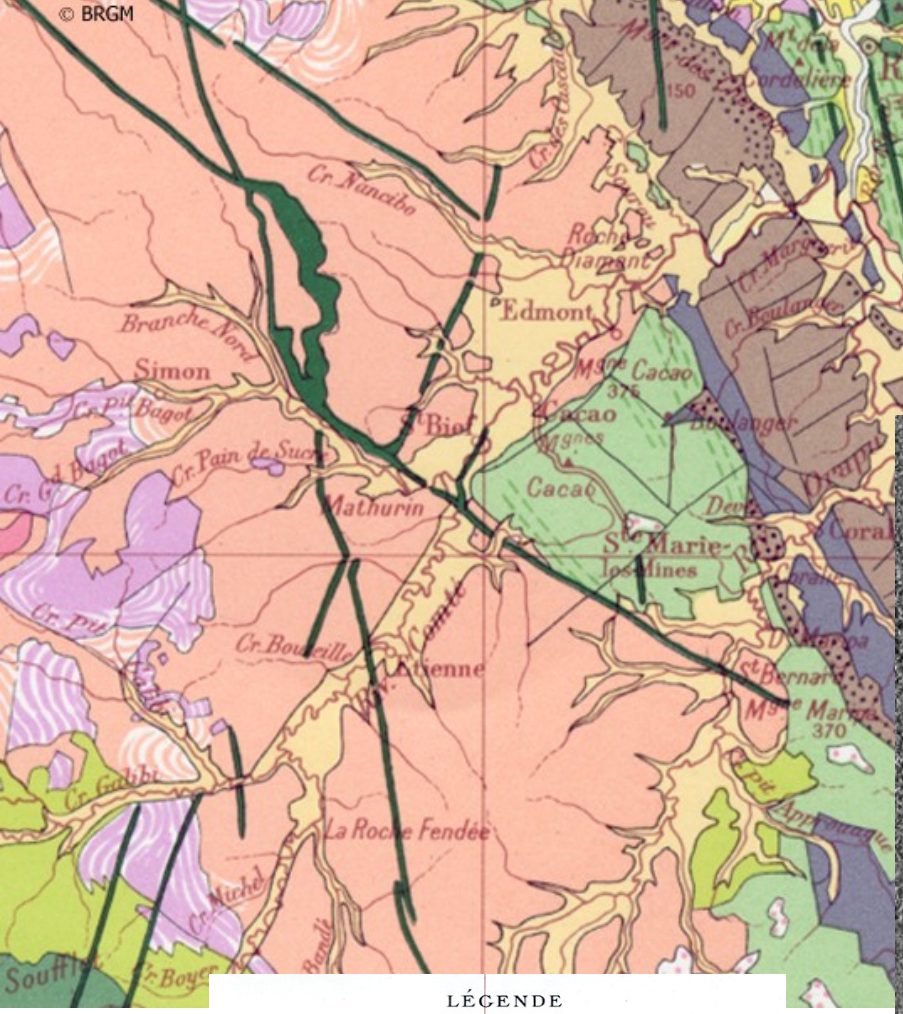
a. ERS-2 image acquired on 27/1/97, with incidence angles 24° - 26°

b. Radarsat fine beam image acquired on 2/2/97, with incidence angles 41° - 44°

Relief effects



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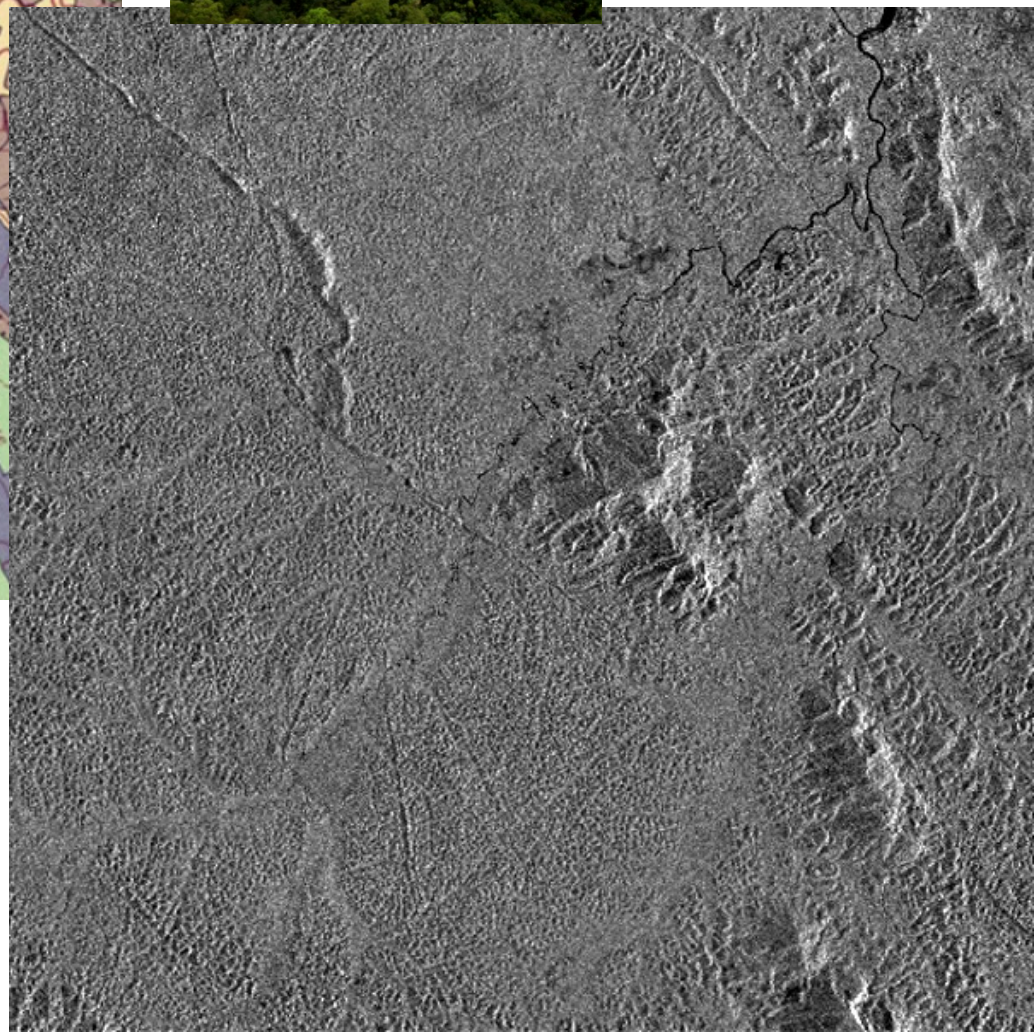
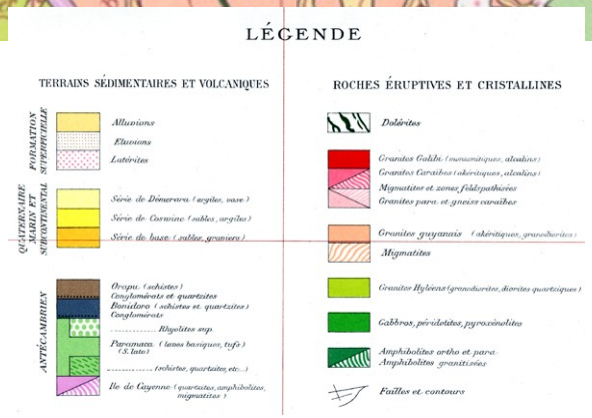
Edmont
Branche Nord
Simon
Cr. Pain de Sucre
Mathurin
Cacao
Cr. Boutreille
La Roche Fendée




LÉGENDE
TERRAINS SÉDIMENTAIRES ET VOLCANIQUES
ROCHES ÉRUPTIVES ET CRISTALLINES
Alluvions
Latérites
Dolérites
Granites Galibi
Granites Caraïbes
Migmatites
Granites gneissiques
Granites guyanais
Granites Hyléens
Gabbros
Amphibolites
Failles et contours

TAKE HOME MESSAGE

Due to side looking geometry, radar more sensitive to relief
than optical dat (nadir view)

Foreshorting: slopes facing the radar
extension: slopes backward to the radar

Ortho-rectification
geometrical correction (foreshorting, extension)
no radiometrical correction (due to σ^0 angular signature)

recommandation: mask high slopes values (> 20°)