

Exercise 1: Step 8 - Slope correction

Radar backscatter: Ellipsoid-normalisation

Conventional Radar Backscatter

- Backscatter coefficients [dB/m²] are ratio of scattered to incident power per unit area:

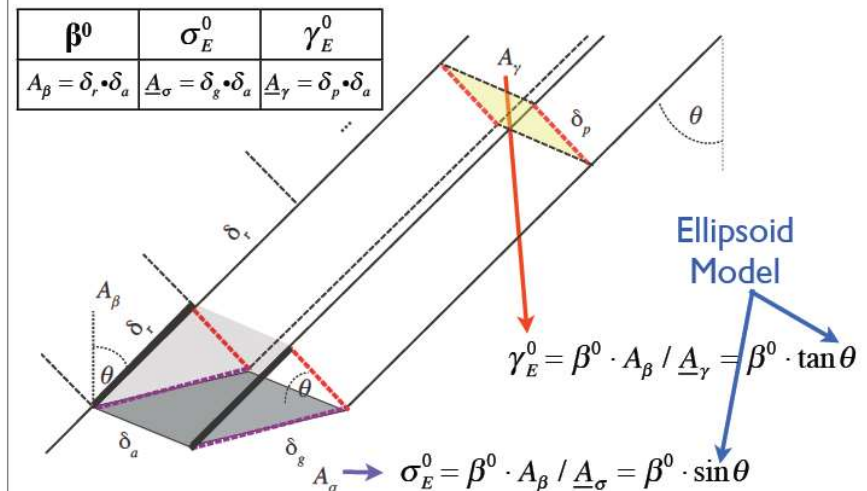
$$\beta = k \cdot \frac{P_s}{P_i} \quad \beta^0 = \frac{\beta}{A_\beta} \quad \sigma_E^0 = \frac{\beta}{A_\sigma} \quad \gamma_E^0 = \frac{\beta}{A_\gamma}$$

- Known: transmitted & received power P_t & P_r
- Derive: incident & scattered power P_i & P_s from P_t & P_r

$$\beta^0 = k \cdot \frac{f_2(P_r)}{f_1(P_t)} \cdot \frac{1}{A_\beta} \quad \sigma_E^0 = k \cdot \frac{f_2(P_r)}{f_1(P_t)} \cdot \frac{1}{A_\sigma} \quad \gamma_E^0 = k \cdot \frac{f_2(P_r)}{f_1(P_t)} \cdot \frac{1}{A_\gamma}$$

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Ground Illuminated Area



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Ellipsoid-normalisation

ASAR: Calibrated sigma nought for detected products can be derived as:

$$\sigma_{i,j}^0 = \frac{DN_{i,j}^2}{K} \sin(\alpha_{i,j})$$

β^0

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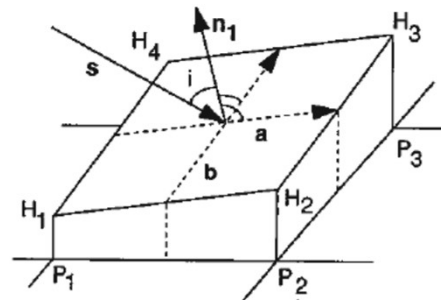
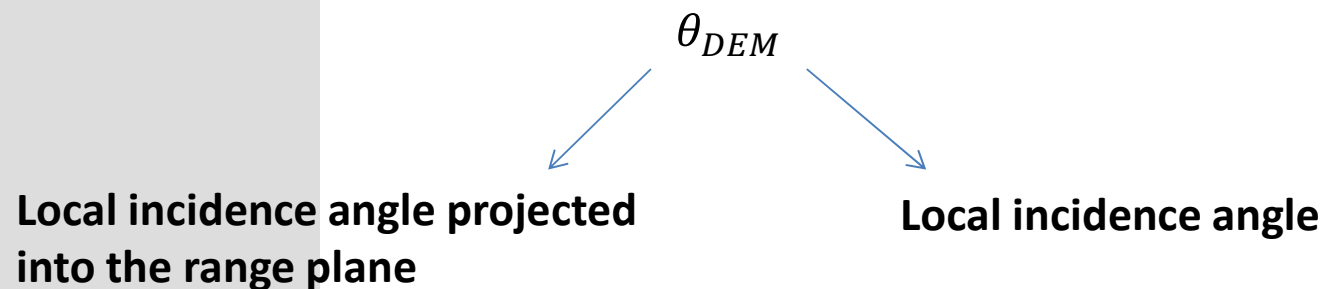
Radar backscatter: slope-normalisation

Normalisation for local variation of scattering

area:

$$\sigma_{Norm}^0 = \sigma_{Ellipsoid}^0 * \frac{\sin \theta_{DEM}}{\sin \theta_{Ell.}}$$

Kellindorfer et al., TGRS, Sept. 1998.



Exercise 1: Step 8 - Slope correction (KellIndorfer) - VV

The screenshot shows the QGIS desktop environment. The 'Raster' menu is open, and 'Band Maths...' is highlighted. Below it, the 'Band Maths' dialog box is open, showing the following configuration:

- Target product: [4] S1A_IW_GRDH_1SDV_20150527T061437_20150527T061502_006103_007EAA_875A_Orb_Noise-Cor_Cal_ML2_Spk_TC
- Name: Sigma0_VV_Norm
- Description: Intensity
- Unit: (empty)
- Spectral wavelength: 0.0
- Virtual (save expression only, don't store data)
- Replace NaN and infinity results by: NaN
- Generate associated uncertainty band
- Band maths expression: $(\text{Sigma0_VV} * \sin(\text{PI} * \text{projectedLocalIncidenceAngle} / 180)) / \sin(\text{PI} * \text{incidenceAngleFromEllipsoid} / 180)$

Buttons at the bottom of the dialog include 'Load...', 'Save...', 'Edit Expression...', 'OK', 'Cancel', and 'Help'.

1. CLICK on the “Raster → Band Maths”

- 2. Name: Sigma0_VV_Norm
- 3. Description: Intensity
- 4. Click Edit Expression (see next slide)
(insert the expression)
- 5. Click ok

Exercise 1: Step 8 - Slope correction (Kellndorfer) - VV



Exercise 1: Step 8 - Slope correction (KellIndorfer) - VH

The screenshot shows the QGIS interface. The 'Raster' menu is open, and 'Band Maths...' is highlighted. The 'Band Maths' dialog box is open, showing the following details:

- Target product: [4] S1A_IW_GRDH_1SDV_20150527T061437_20150527T061502_006103_007EAA_875A_Orb_Noise-Cor_Cal_ML2_Spk_TC
- Name: Sigma0_VHNorm
- Description: Intensity
- Unit: (empty)
- Spectral wavelength: 0.0
- Virtual (save expression only, don't store data)
- Replace NaN and infinity results by: NaN
- Generate associated uncertainty band
- Band maths expression: $(\text{Sigma0_VV} * \sin(\text{PI} * \text{projectedLocalIncidenceAngle} / 180)) / \sin(\text{PI} * \text{incidenceAngleFromEllipsoid} / 180)$

Buttons at the bottom of the dialog include 'Load...', 'Save...', 'Edit Expression...', 'OK', 'Cancel', and 'Help'.

1. CLICK on the “Raster → Band Maths”

- 2. Name: Sigma0_VH_Norm
- 3. Description: Intensity
- 4. Click Edit Expression (see next slide)
(insert the expression)
- 5. Click ok

Exercise 1: Step 8 - Slope correction (Kellndorfer) - VH

