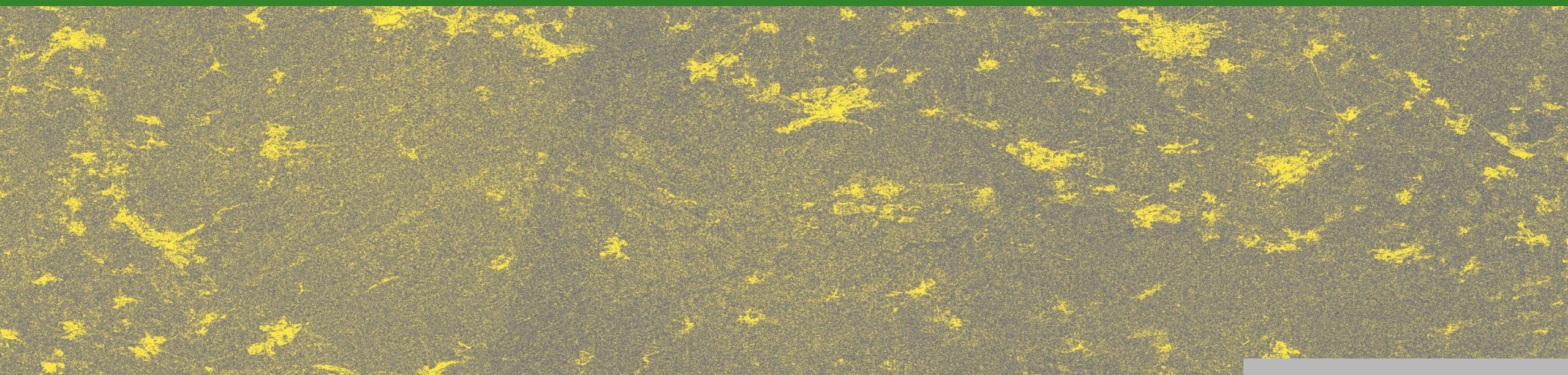


SAR data for time series analysis

Johannes Löw

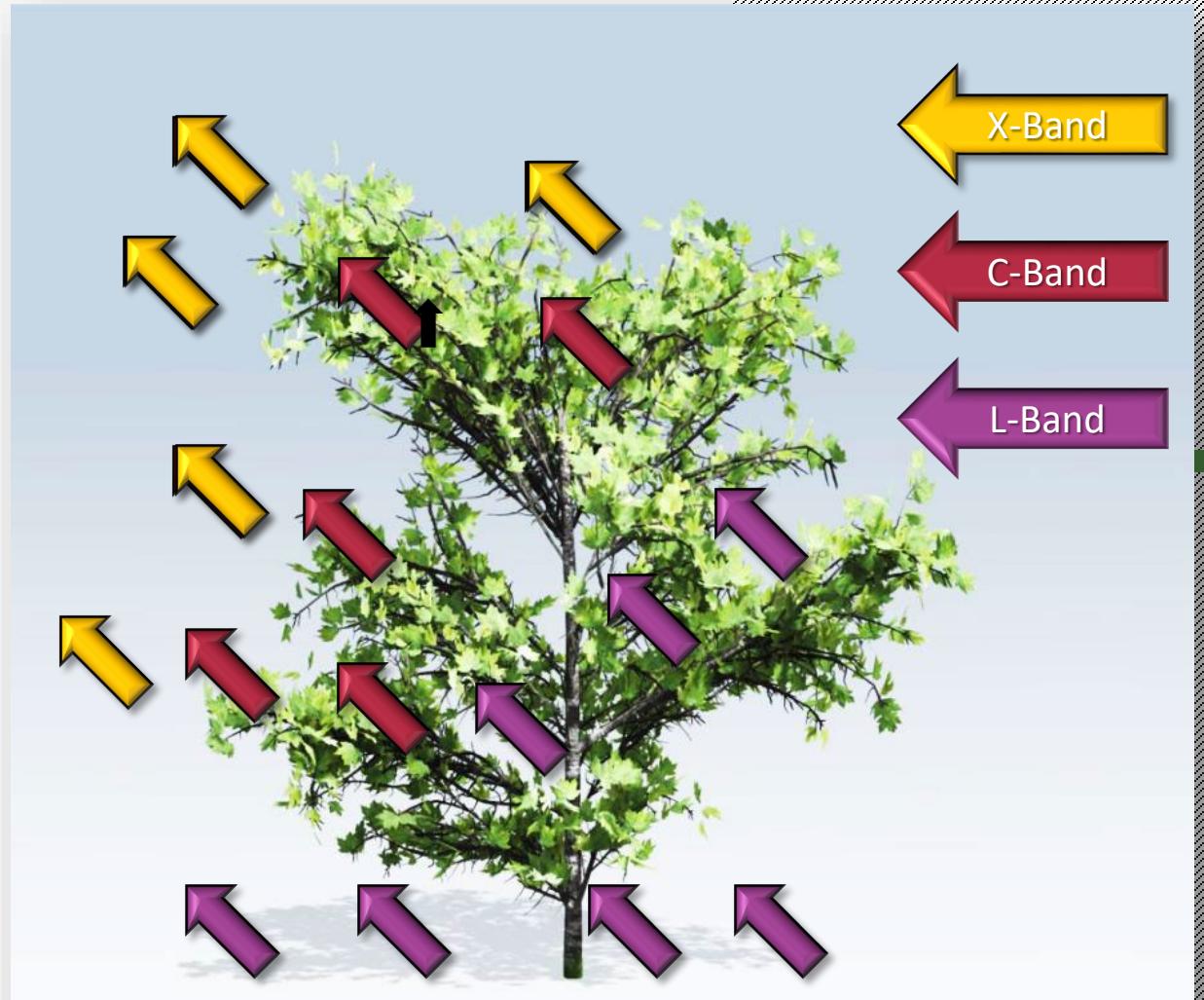
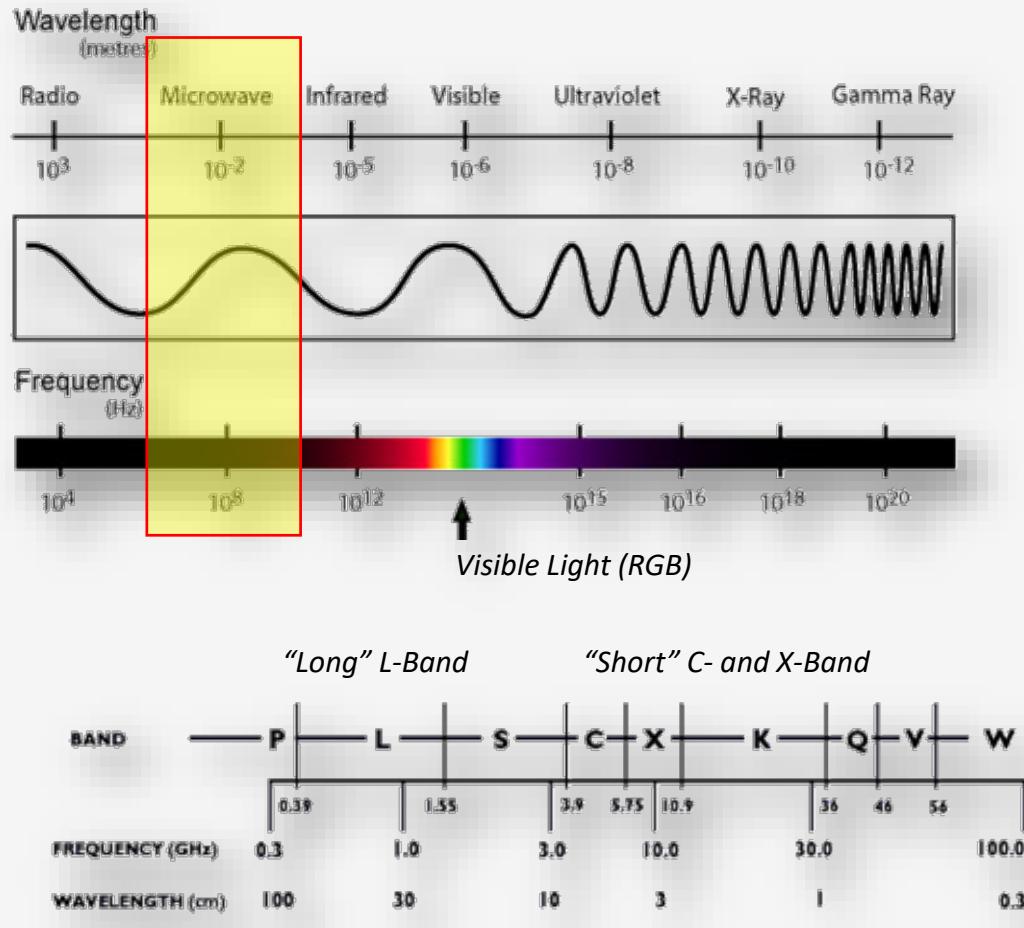
Department of Geoecology, Institute of Geosciences and Geography, University of Halle-Wittenberg





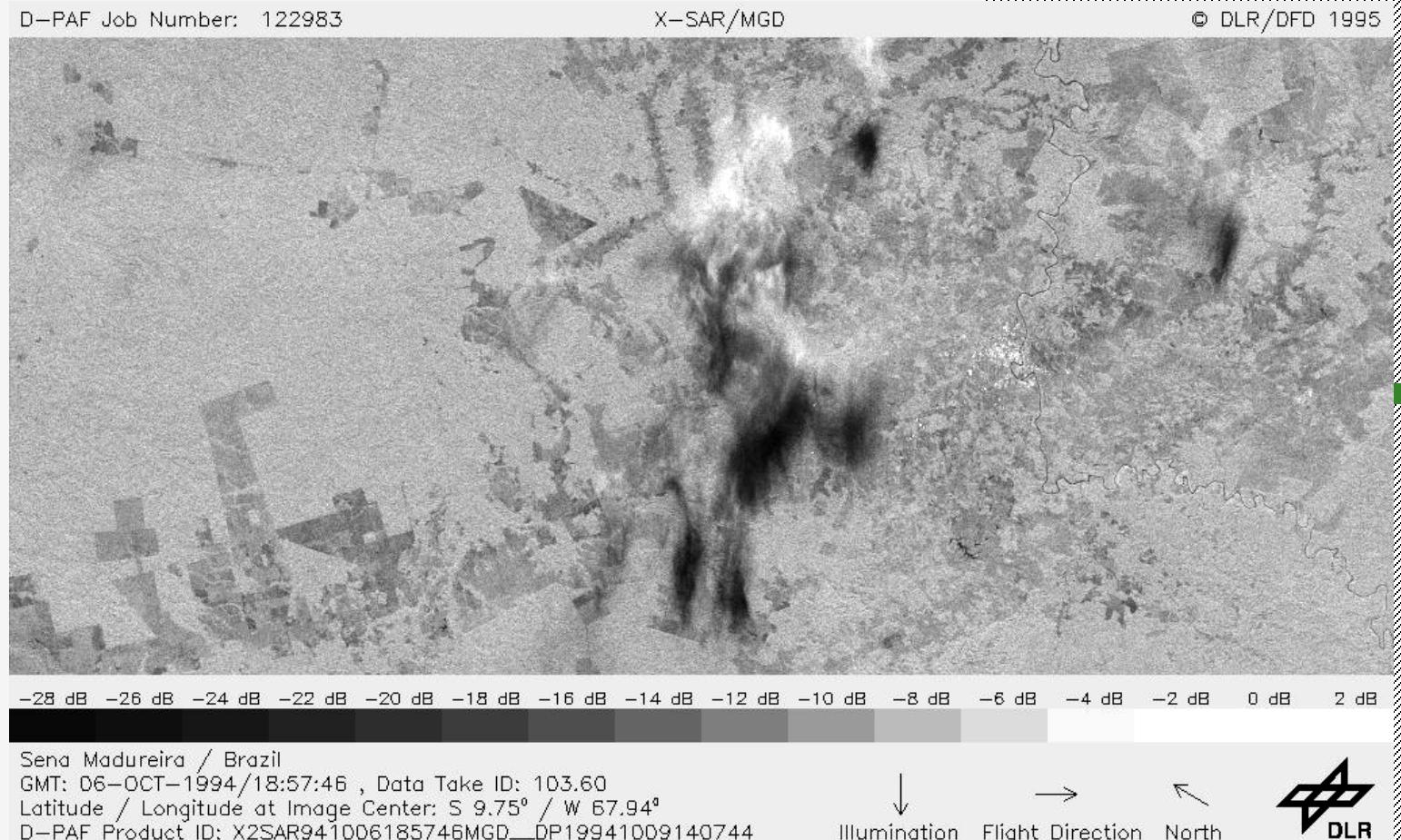
“The fundamental reason for using microwaves in remote sensing is that they are different.”
Woodhouse (2006)

Back to basics: RADAR edition: Spectrum & Bands



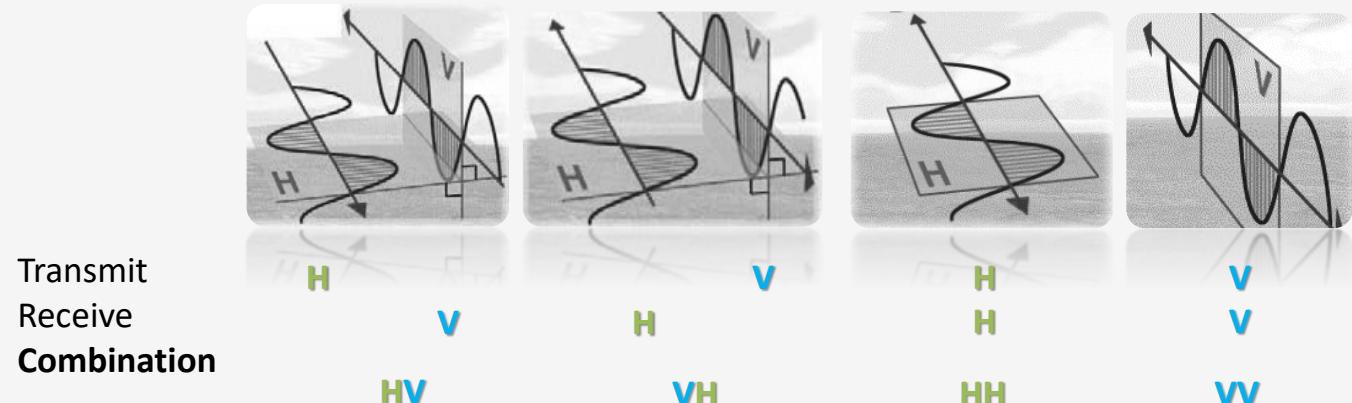
Back to basics: RADAR edition: immunity to clouds

No clouds in Radar images?
Only visible at short
wavelengths and extreme
conditions



Heavy Clouds and Rain Cells in X-Band SAR Images

Back to basics: RADAR edition: polarizations



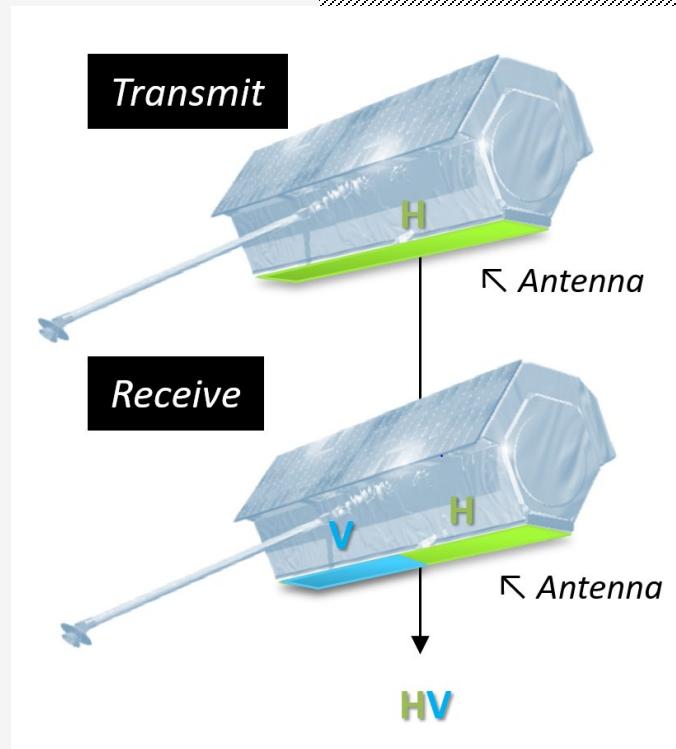
1/4 Resolution

Quad-pol. → $S = \begin{bmatrix} S_{HH} & S_{HV} \\ S_{VH} & S_{VV} \end{bmatrix}$

Co-pol. → $S = \begin{bmatrix} S_{HH} & \\ & S_{VV} \end{bmatrix}$

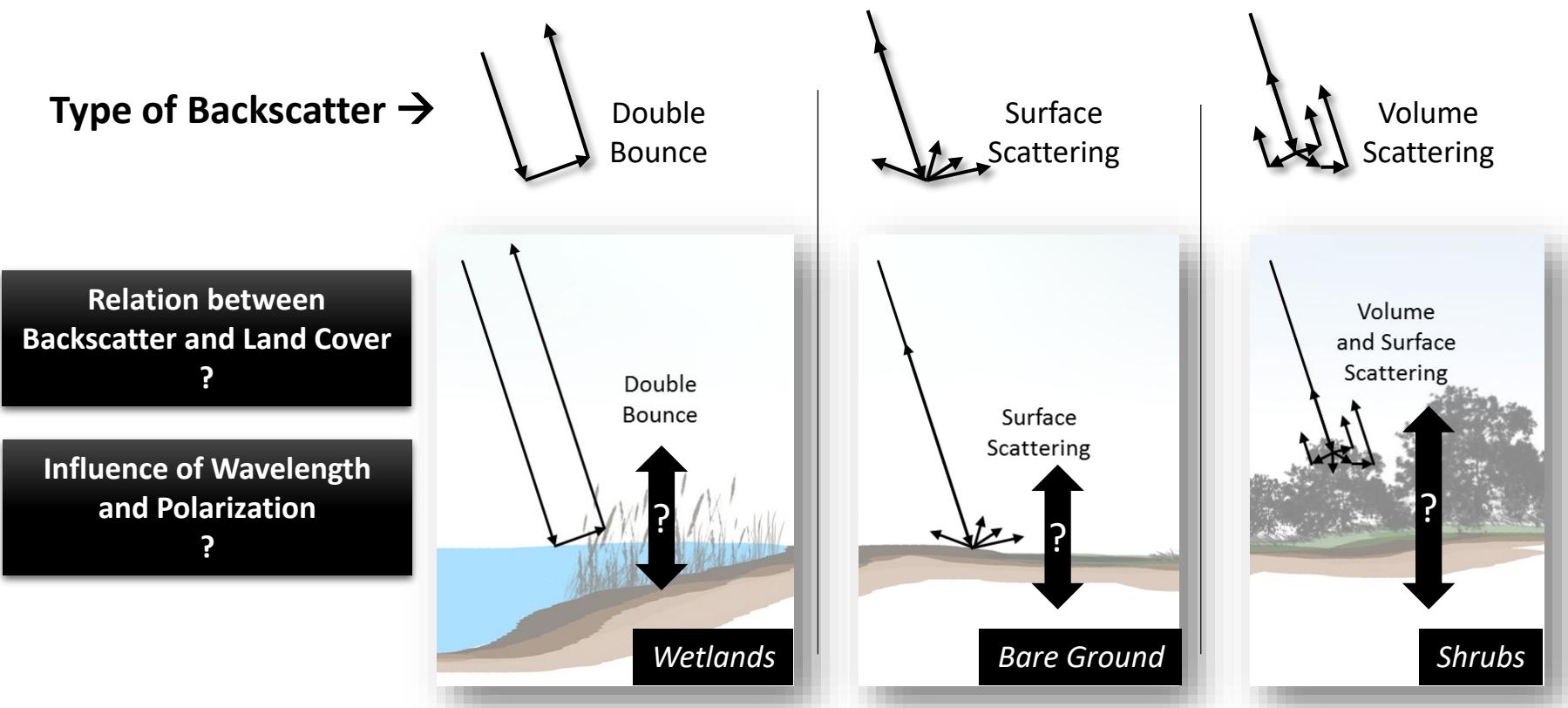
Cross-pol. → $S = \begin{bmatrix} S_{HH} & S_{HV} \\ S_{VH} & \end{bmatrix} \quad / \quad S = \begin{bmatrix} S_{HH} & S_{HV} \\ S_{VH} & S_{VV} \end{bmatrix}$

1/2 Resolution



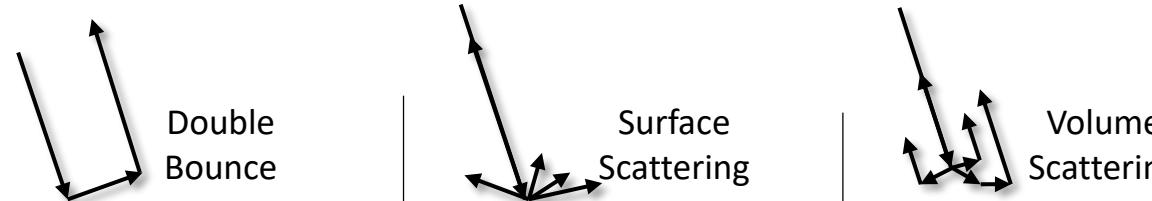


Back to basics: RADAR edition: interaction signal-object



Back to basics: RADAR edition: interaction signal-object

Type of Backscatter →



	Double Bounce	Surface Scattering	Volume Scattering	
$\begin{bmatrix} S_{HH} & S_{HV} \\ S_{VH} & S_{VV} \end{bmatrix}$	Quad-pol.	✓	✓	✓
$\begin{bmatrix} S_{HH} \\ S_{VV} \end{bmatrix}$	Co-pol.	✓	✓	✗
$\begin{bmatrix} S_{HH} & S_{HV} \\ S_{VH} & S_{VV} \end{bmatrix}$	Cross-pol.	✗	✗	✓
$\begin{bmatrix} S_{VH} & S_{VV} \end{bmatrix}$	Cross-pol.	✗	✗	✓

Back to basics: RADAR edition: signal interpretation PolSAR

PolSAR Intensities
(HH/HV/VH/VV)

HH = sensitive to horizontal structures

HV = „sensitive to random scattering media“

VH = „sensitive to random scattering media“

VV = sensitive to vertical structures

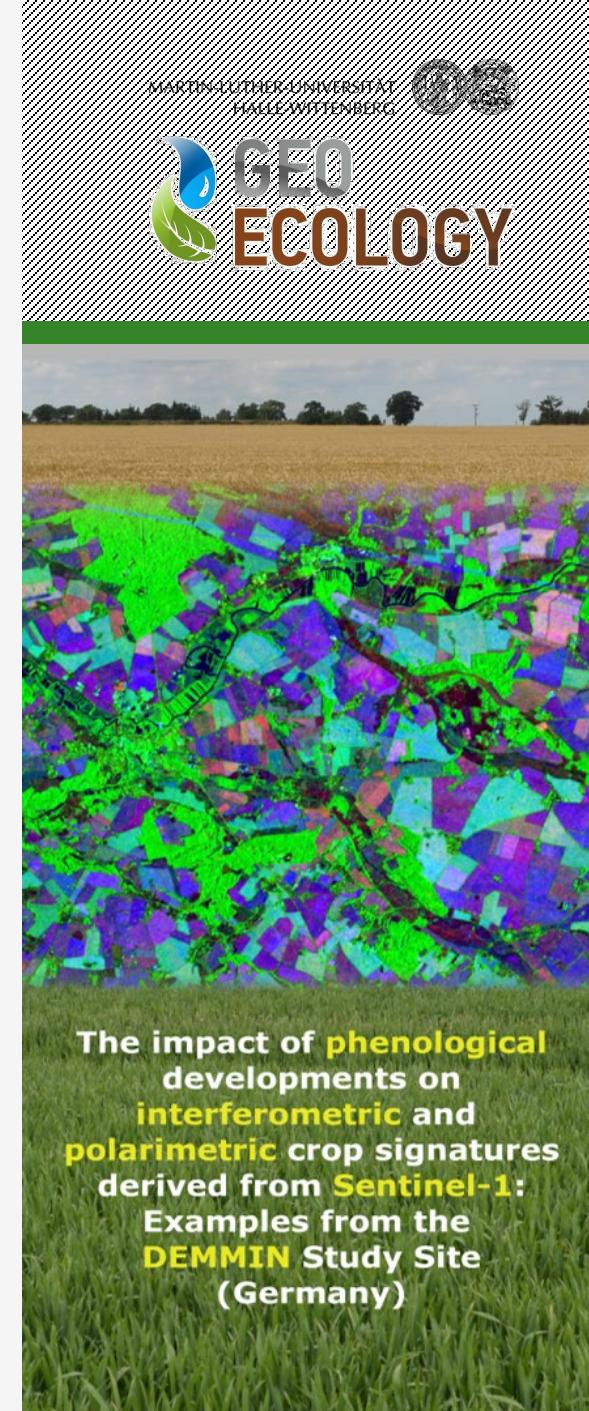
Entropy/Anisotropy/
Alpha

Entropy = Degree of randomness
[0;1]

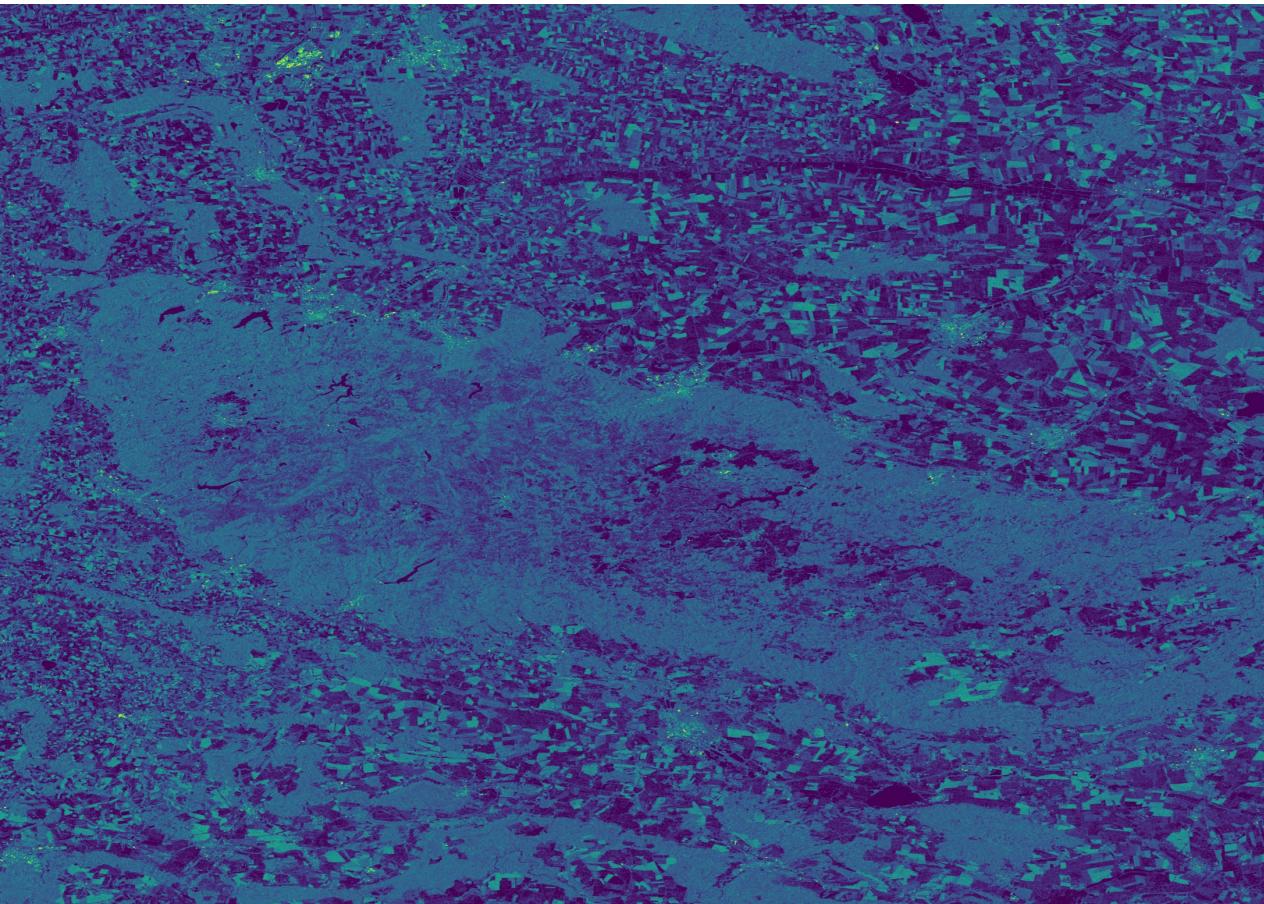
Anisotropy = Secondary Scattering Processes [0;1]

Alpha of T3 and T2 = Type of Scattering [0;90]

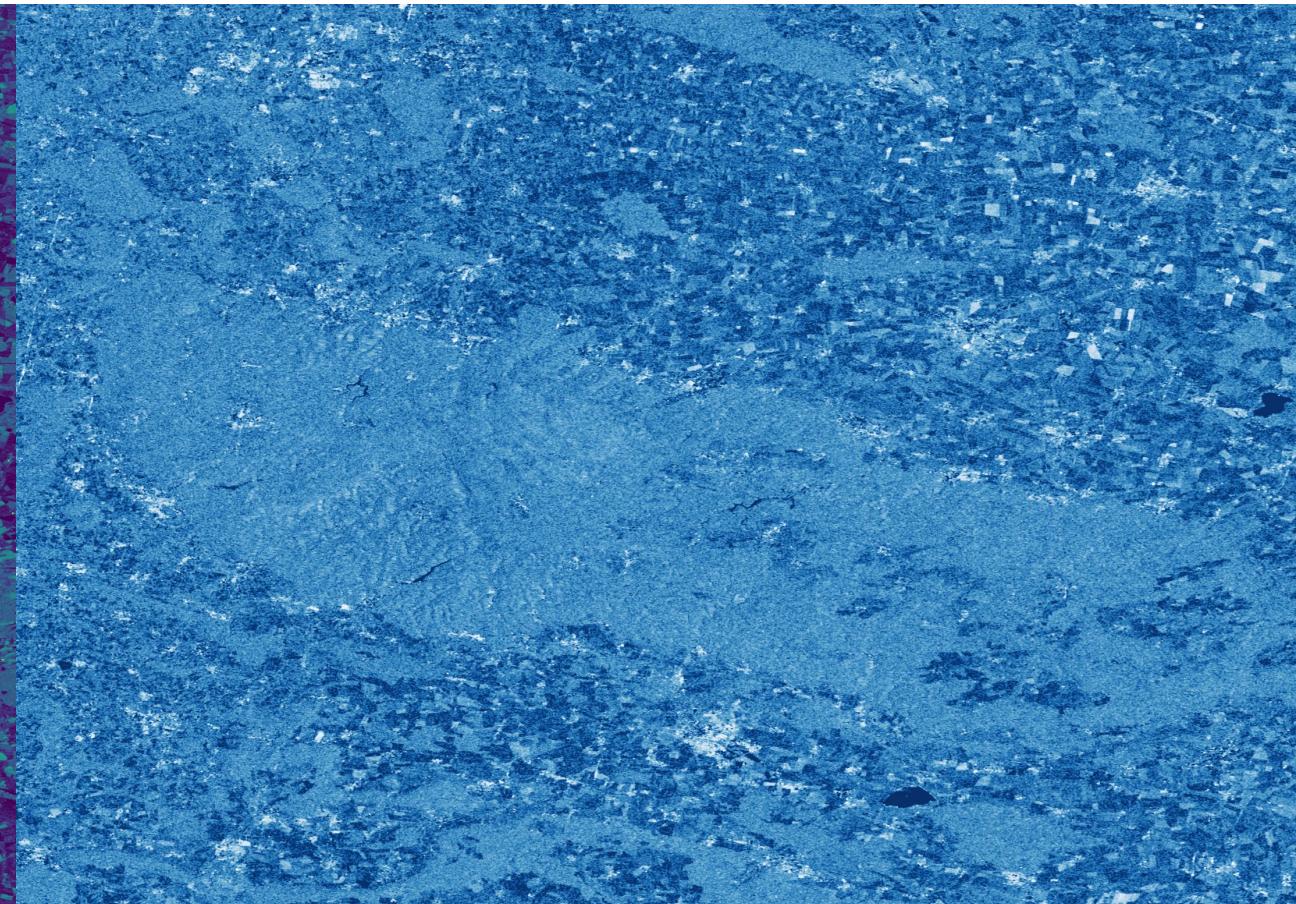
Alpha of C2 and C3 = Dominance of HH or HV or VV scattering [0;90]



Backscatter intensity VH 2022/06/18



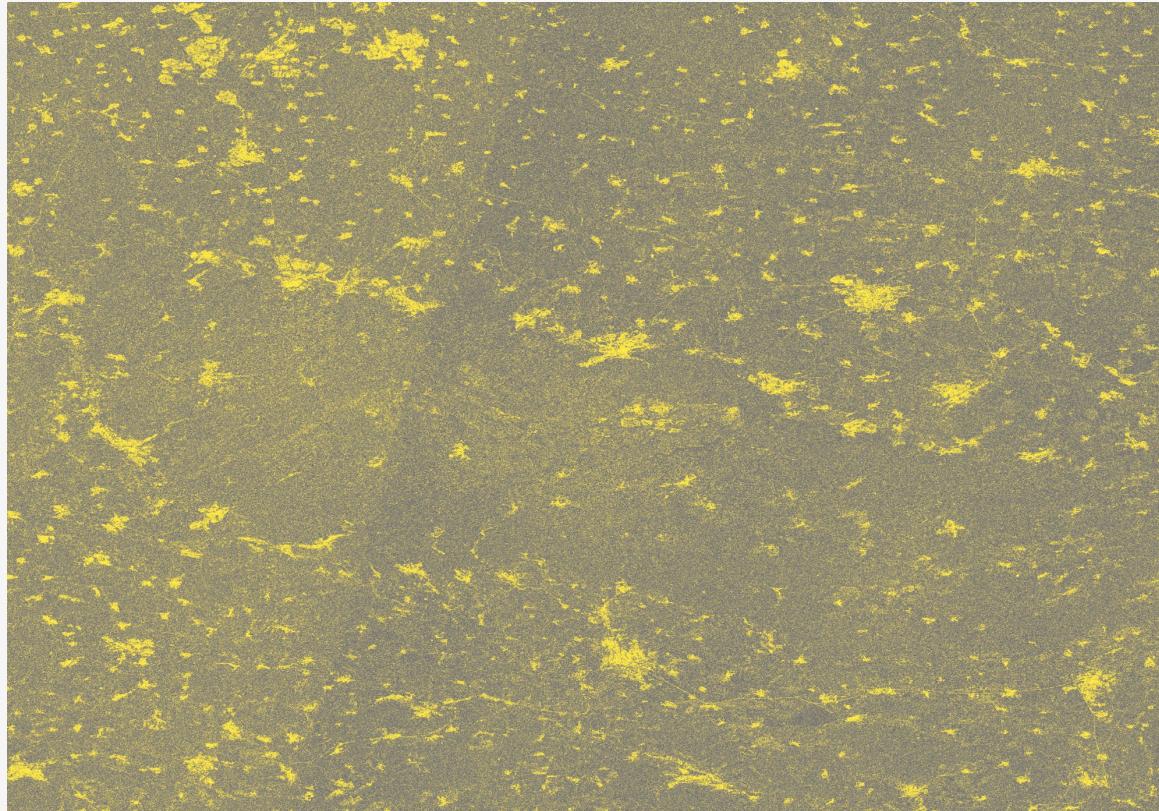
Alpha 2022/06/18



Back to basics: RADAR edition: signal interpretation InSAR

InSAR-coherence =

*Temporal correlation*Thermal noise*Spectral correlation*Volume backscattering*



InSAR coherence VH 2022/06/18 to 2022/06/30

Important for InSAR-coherence:
Repeat-pass interferometry mainly dominated by **temporal** correlation



Questions?