### The BIOMASS Mission: Secondary Objectives (actually not that secondary...)

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#### **My Short History of Remote Sensing**



C-Band (HH, HV, VV)



L-Band (HH,HV,VV)









Visible

Near IR

Therm IR

X/C/L SAR

P-band SAR (Lidar)



#### The ESA 7<sup>th</sup> Earth Explorer Mission: BIOMASS





 $\rightarrow$  First orbital P-band SAR (435 MHz @ 50 m resolution)  $\rightarrow$  Full polarimetry + interferometry + tomography

### Large coverage of continental surfaces



### "Ready to Fly" Secondary Applications

#### → Subsurface Geology Mapping:

The first opportunity to map paleo-hydrology at continental scale in regions where water resources are a serious issue

#### $\rightarrow$ Ice Flow Measurements:

A unique way to measure the seasonal variation of large ice sheets in relationship with climate change monitoring

#### → Digital Elevation Model:

An efficient way to obtain the surface topography under dense vegetation (then useful for biomass measurement)

#### → Ocean Surface Properties:

A new way to look at ocean surface structures + a unique sensitivity to discriminate between fresh/saline water

# **Subsurface Geology Mapping**



P-band radar can penetrate dry sediments (> 5m):

- $\rightarrow$  Maps the bedrock structures under the aeolian sand layer
- $\rightarrow$  Provides information on the hydro-geological history
- $\rightarrow$  Paleo-climatology and fossil water resources



# The TUNISAR experiment

Airborne P-band ONERA/DEMR Tunisia 2010



### **Ice Flow Measurements**



Anticipated benefits of P-band radar:

- $\rightarrow$  Larger coherence time than at lower frequencies
- $\rightarrow$  Deeper penetration into ice to reach stable scatterers
- $\rightarrow$  Access to new time scales to monitor ice flows

## **Digital Elevation Models**



Combine POLINSAR and P-band:

- $\rightarrow$  Larger coherence of large-scale vegetation structures
- $\rightarrow$  Deeper penetration into vegetation to reach the surface
- $\rightarrow$  Terrain topography under dense vegetation

# **Ocean Surface Properties**





Exploring the new frequency of P-band:

- → Strong dielectric contrast between fresh/saline water
- → Access to new surface roughness scale (waves, bathymetry)
- $\rightarrow$  Coastal zones ocean interactions
- $\rightarrow$  Sea ice dynamics and structure

# **Secondary Objectives: Coverage**



**Desert Apps** Ice Apps Ocean Apps

#### → Other significant applications (please contribute)

- Soil moisture and salinity
- Permafrost monitoring
- Volcanic activity monitoring
- Ice sheet structure sounding
- Snow cover properties
- Wetlands monitoring
- Ionosphere structure

- ...

#### → Need for preparatory studies (2020 launch)

- Modeling (polarimetry, tomography, towards 3D)
- Airborne campaigns + field measurements
- Deal with low  $\sigma^0$  (NESZ better than -30 dB)
- Definition of cal/val sites