

Climatic imprint in the mechanical properties of ice sheets and its effect on ice flow. Observations from South Pole and EPICA Dome C ice cores

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Outline

Crystal Orientation Fabric

What is it?

Effects on flow and radar

Climate, fabric and flow

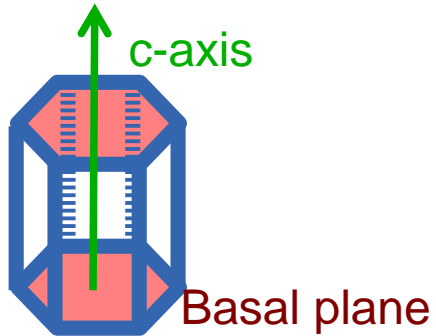
Observations at Dome C and South Pole

Influence of climate on ice flow

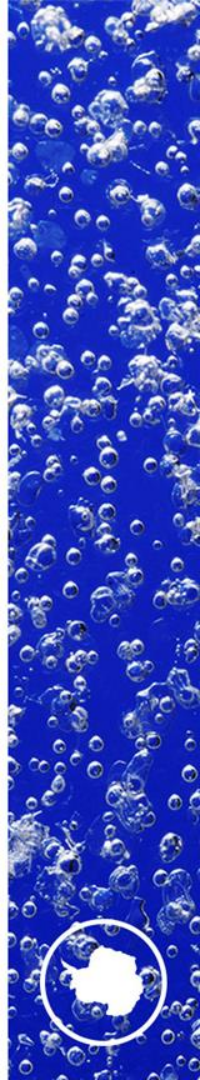
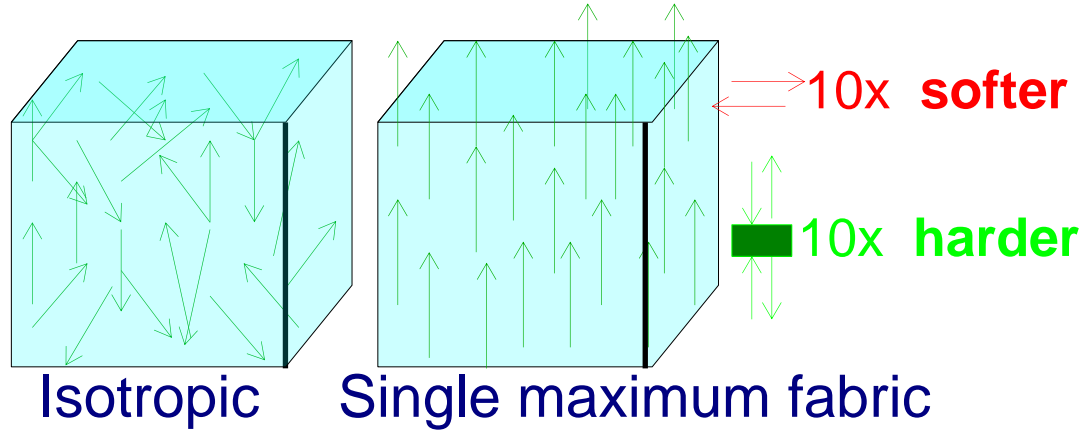


Ice crystal orientation fabric

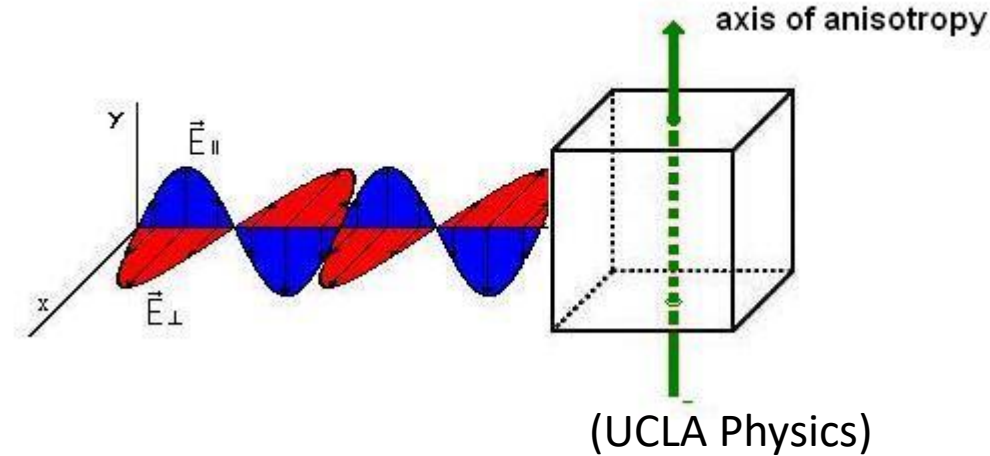
Single crystal



Polycrystal



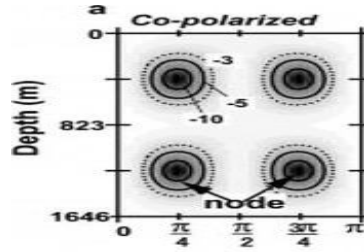
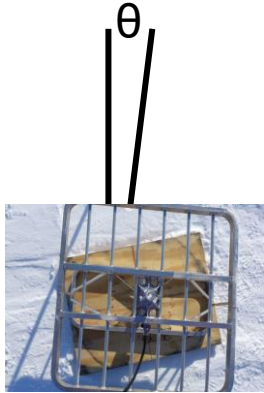
Fabric and optical anisotropy



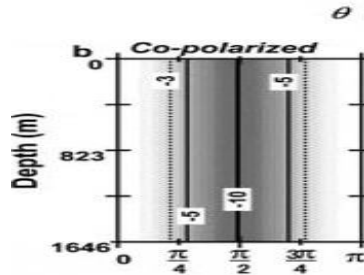
The angle of incidence affects speed of waves
(**Birefringence**) and scattering (**Anisotropic scattering**)



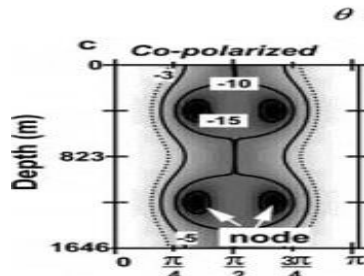
Fabric and radar polarimetry



Birefringence

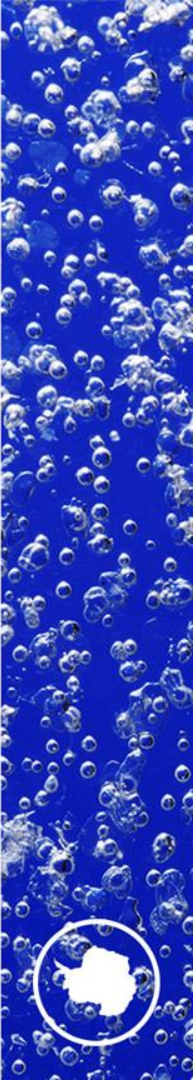


Anisotropic Scattering



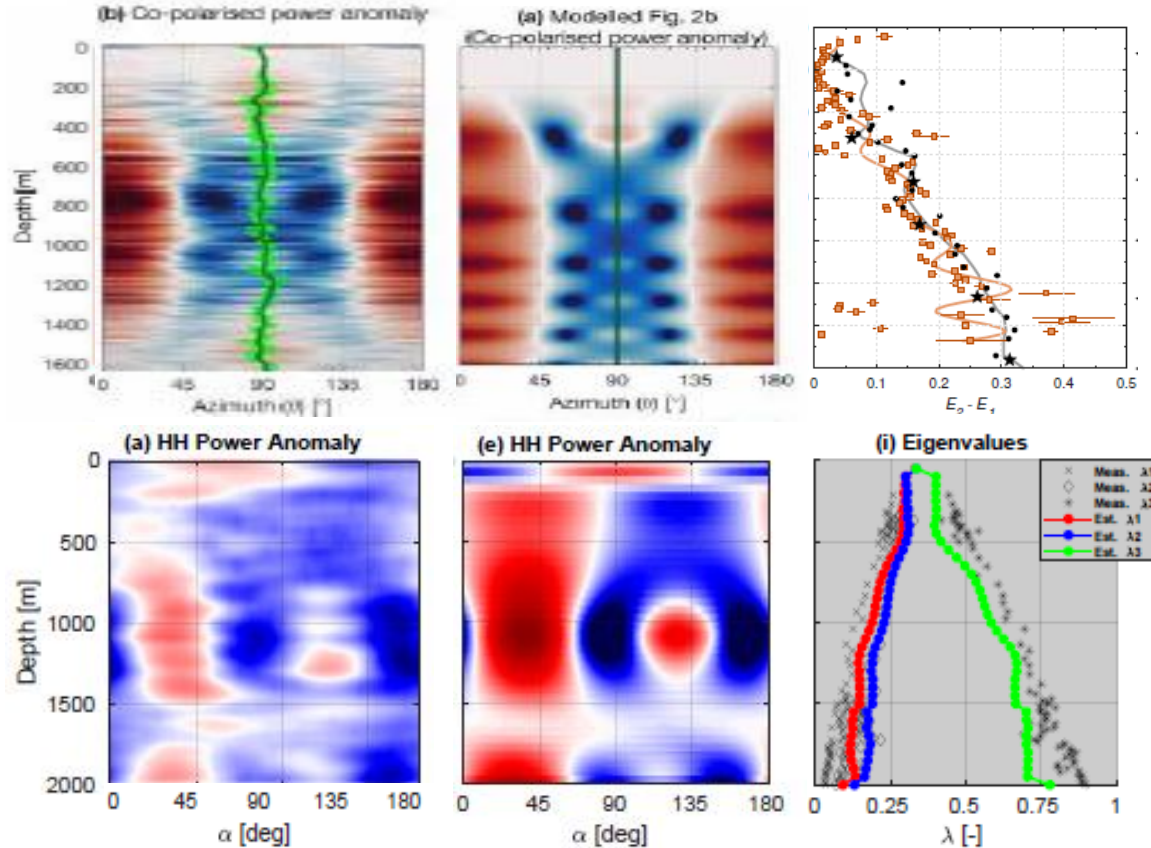
Both

(Hargreaves, 1977;
Fujita et al, 2006)



Fabric and radar polarimetry

WAIS divide
TJ Young et al. TCD



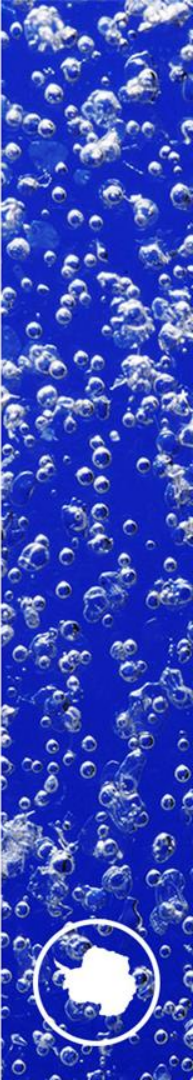
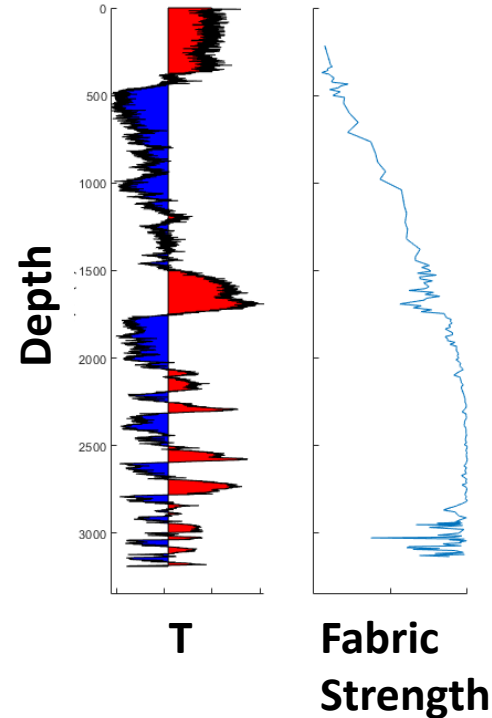
Dome C
M. Reza Ershadi et al. TCD



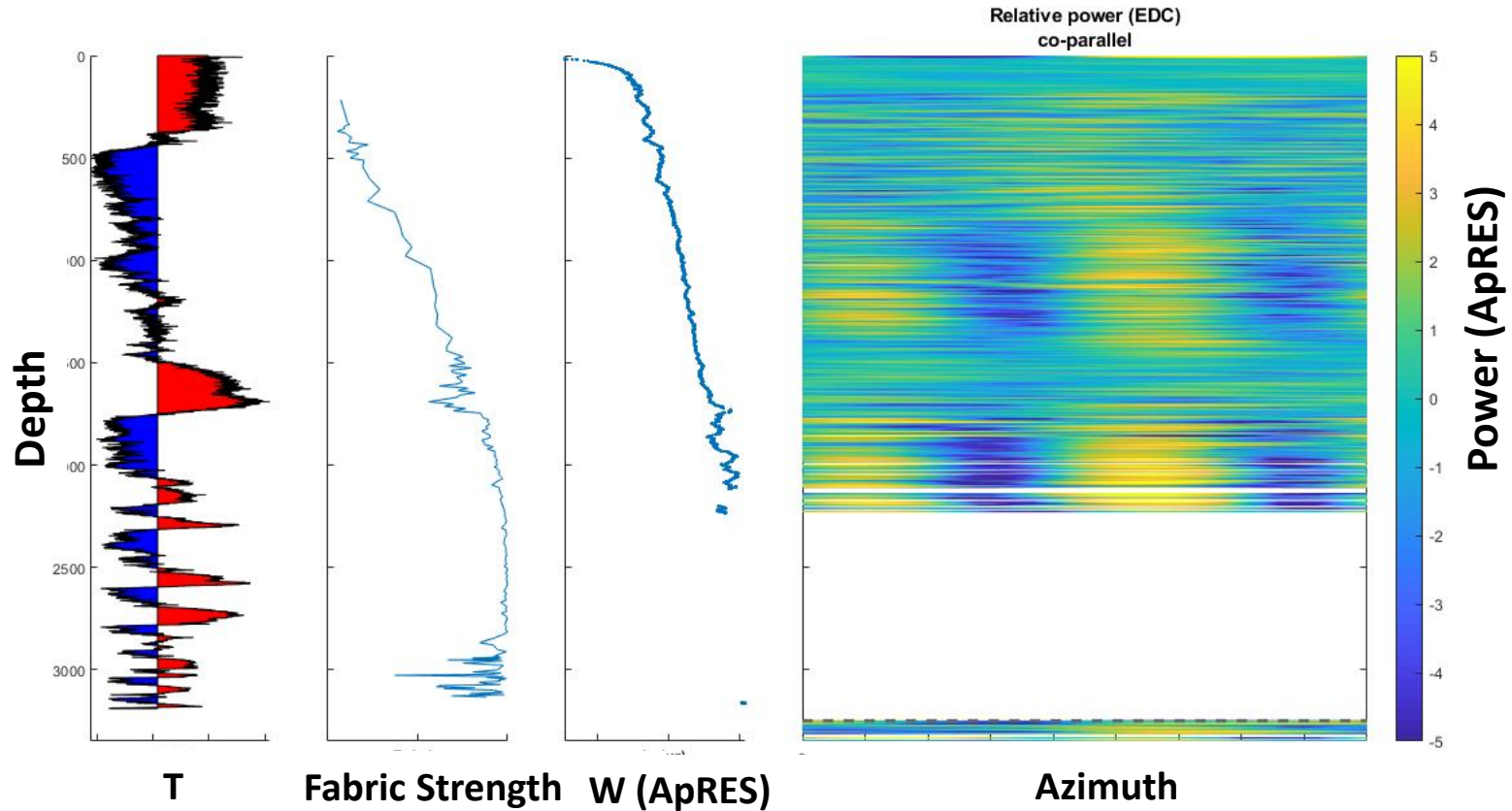
Climate, Fabric and Flow: Motivation

Crystal orientation **fabric** is stronger during **glacial** periods (Durand, 2007)

- Can we detect **glacial/interglacial** and its effect on flow with a **radar**?
- Is the effect on flow significant?



Climate, fabric and flow at Dome C

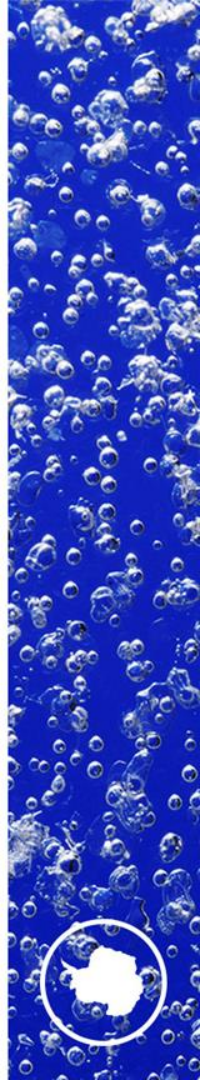
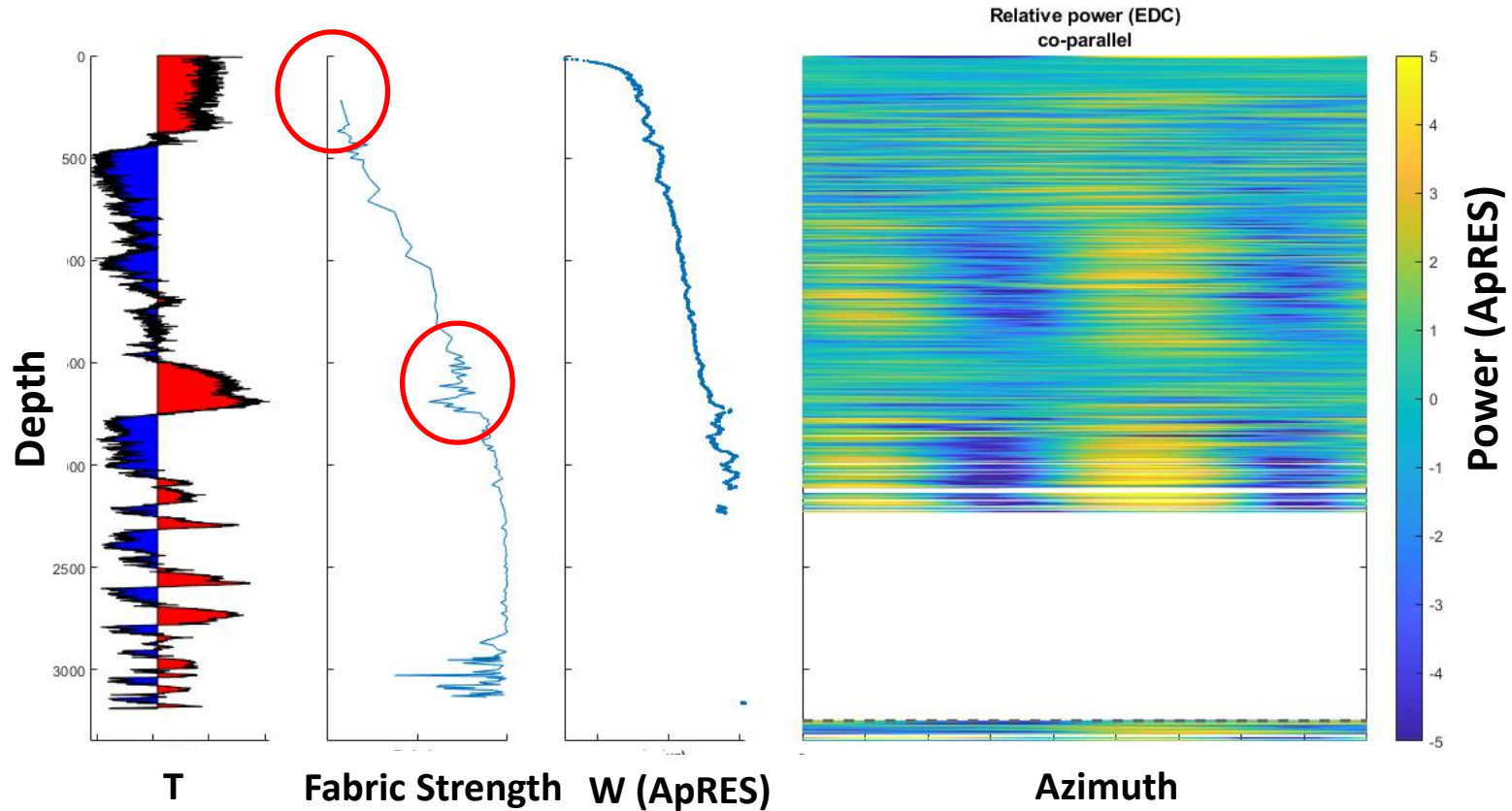


(Jouzel, 2007)

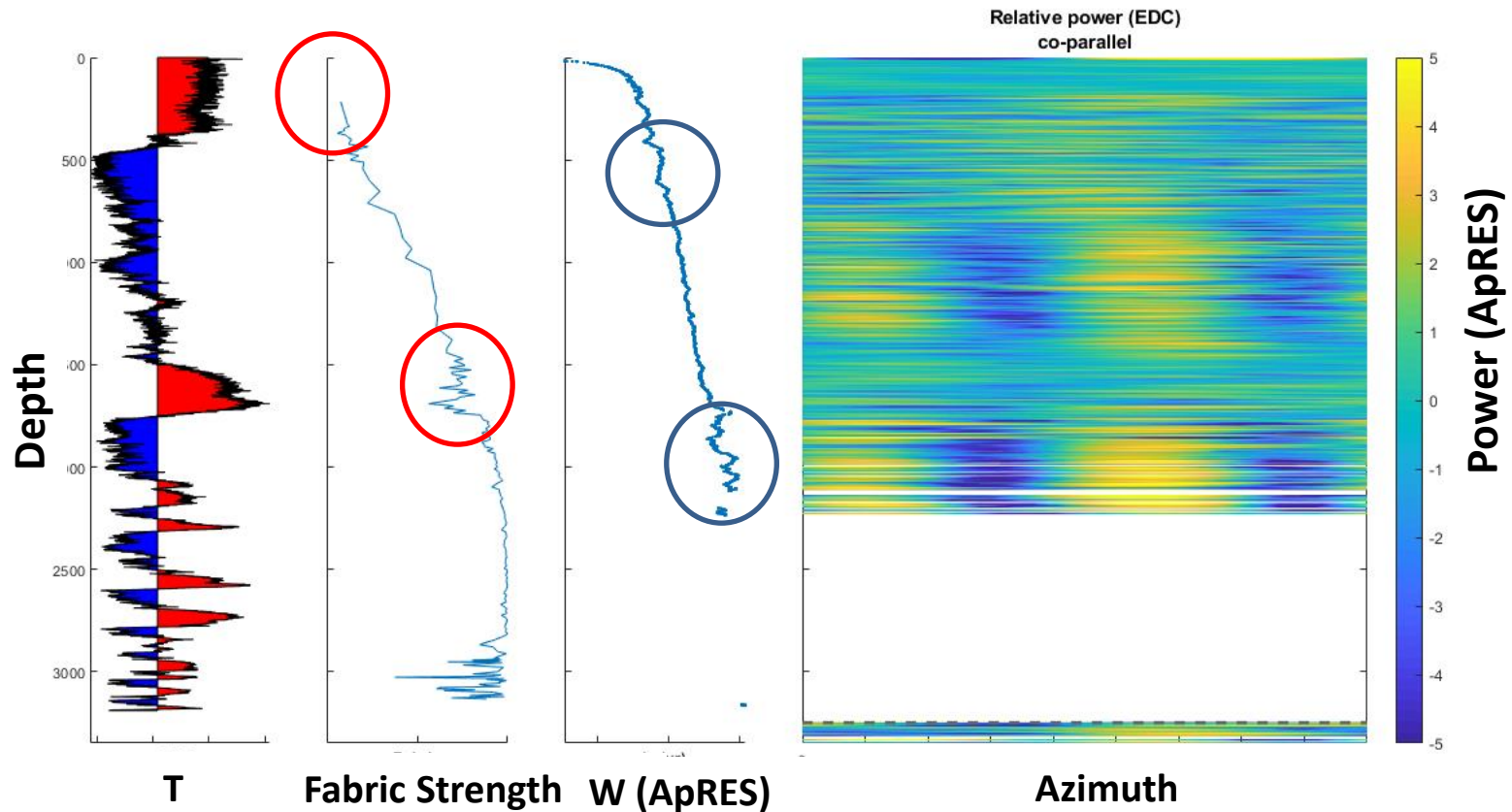
(Durand, 2007)



Climate, fabric and flow at Dome C

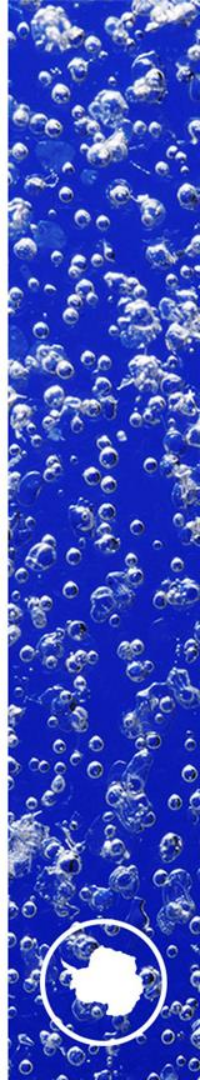
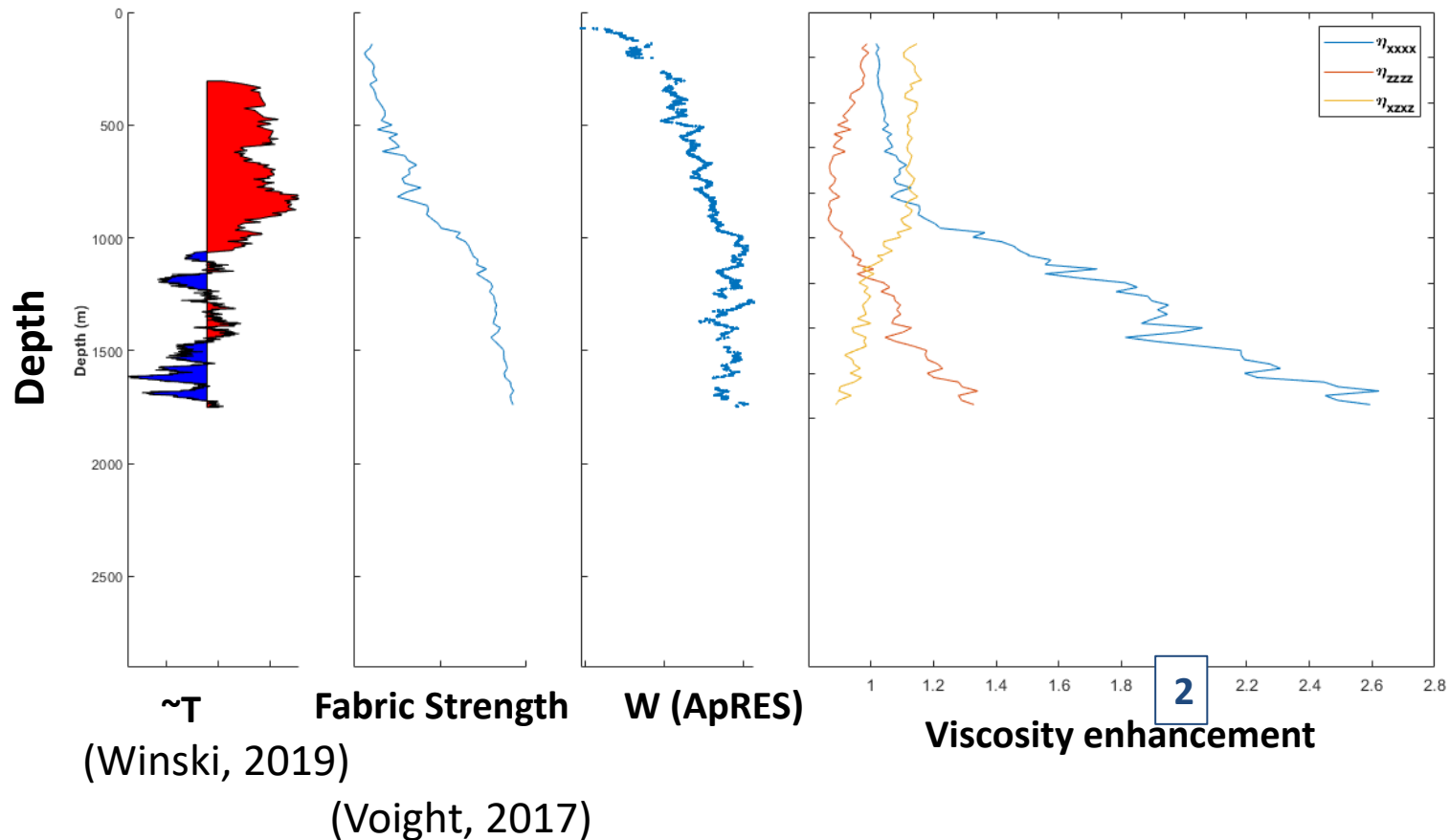


Climate, fabric and flow at Dome C

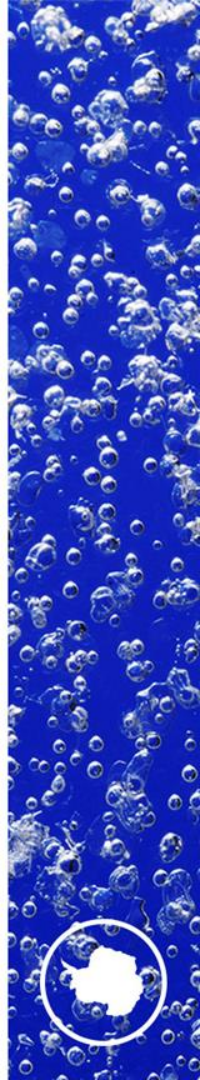
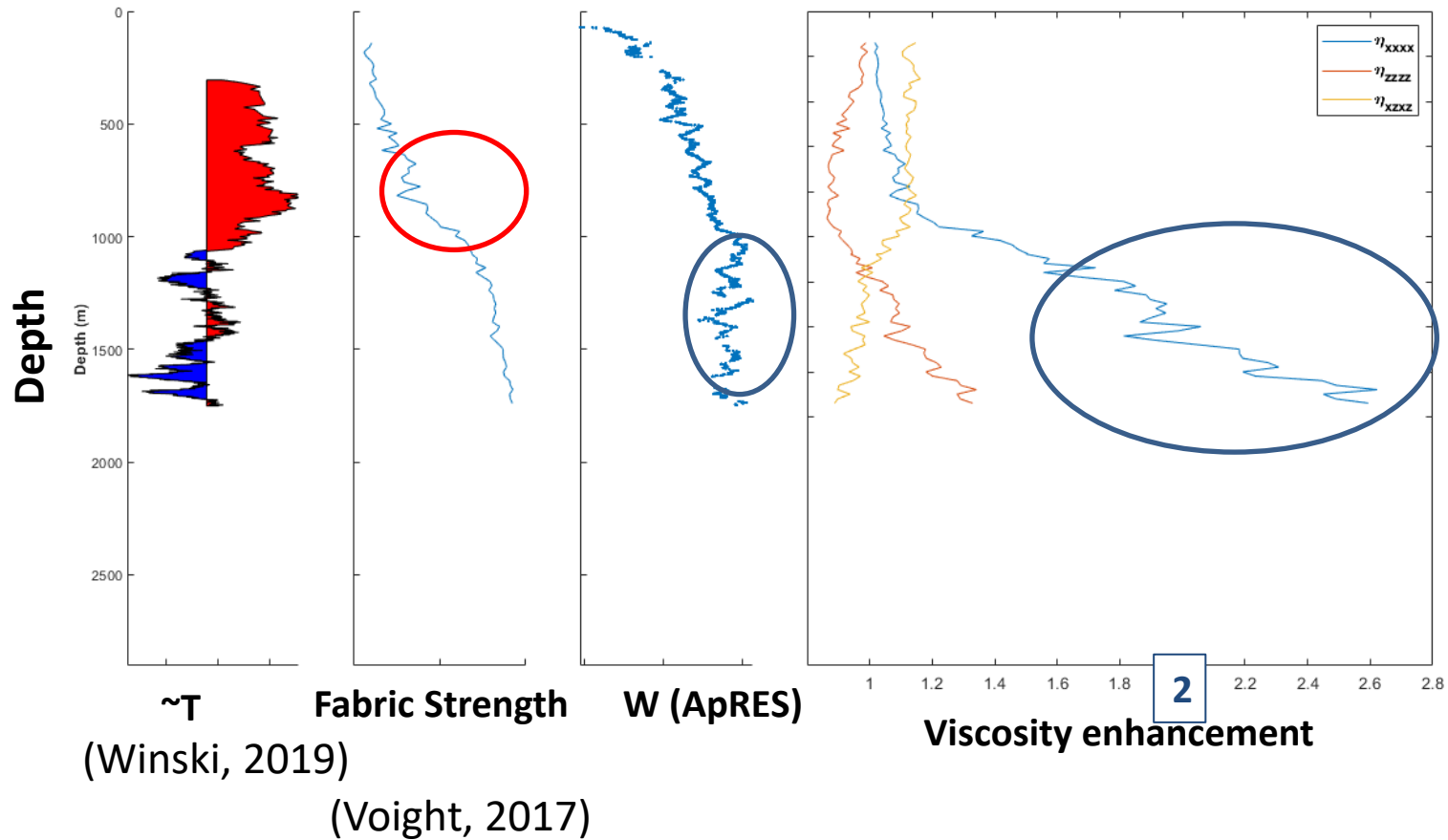


Yes we can detect it with radar **but is that all?**

Climate, fabric and flow at South Pole



Climate, fabric and flow at South Pole



Conclusions and Outlook

Climate → Fabric → Flow

- Can we detect **glacial/interglacial** and its effect on flow with a **radar**?

Yes, at least near Domes

- Is the effect on flow significant?

At South Pole, faster flowing than Dome C, the **viscosity is 2x larger for glacial ice**.

→ Is the effect of glacial/interglacial stronger in fast-flowing areas?

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