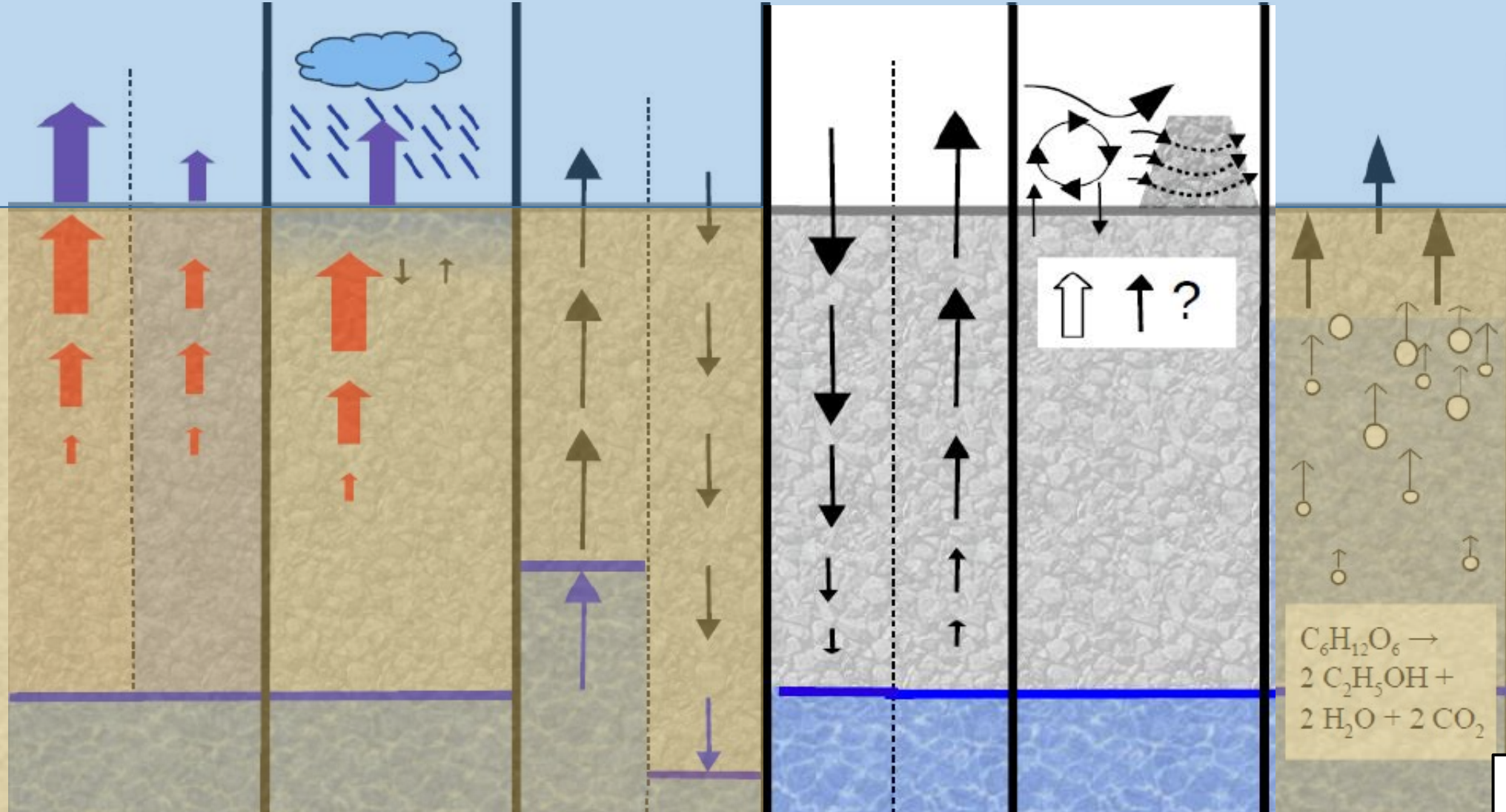


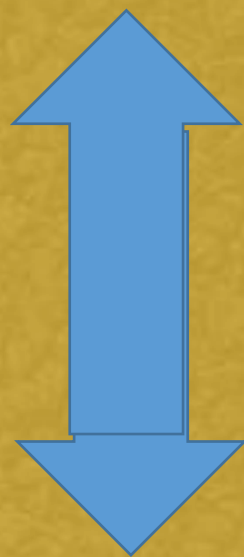
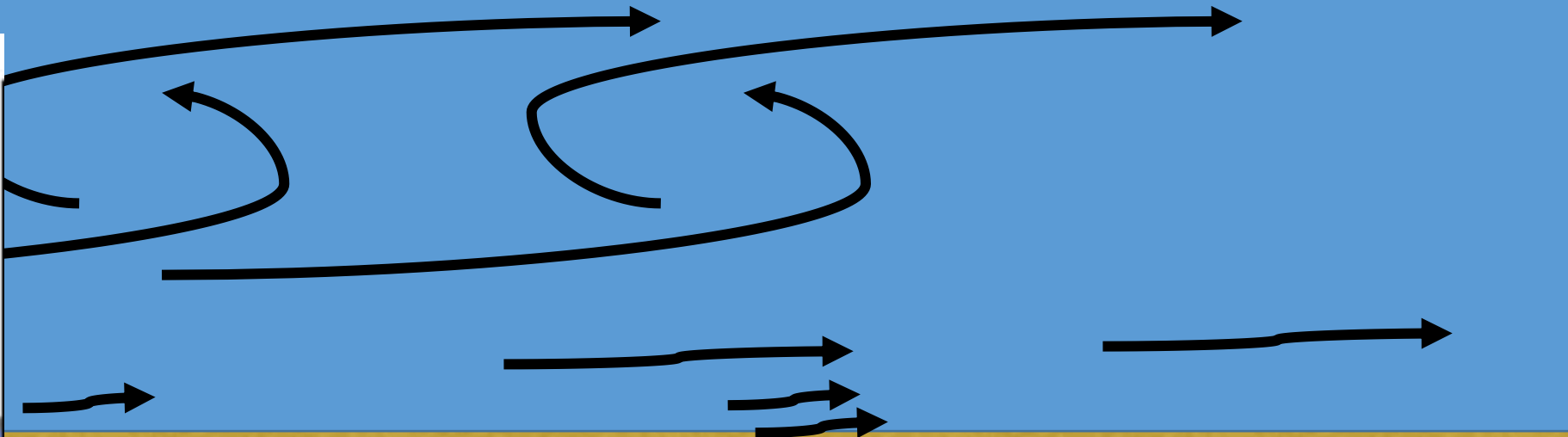
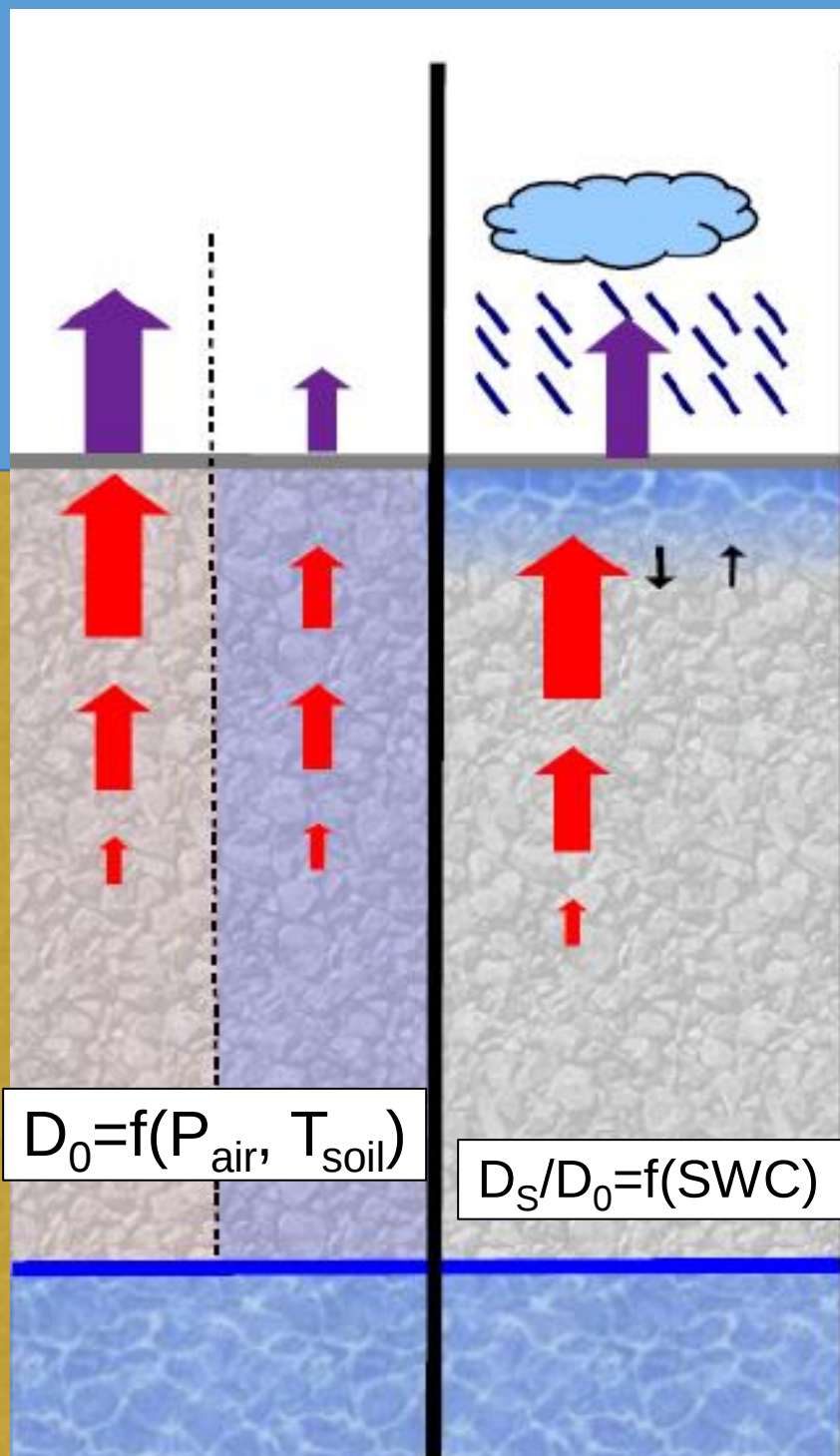


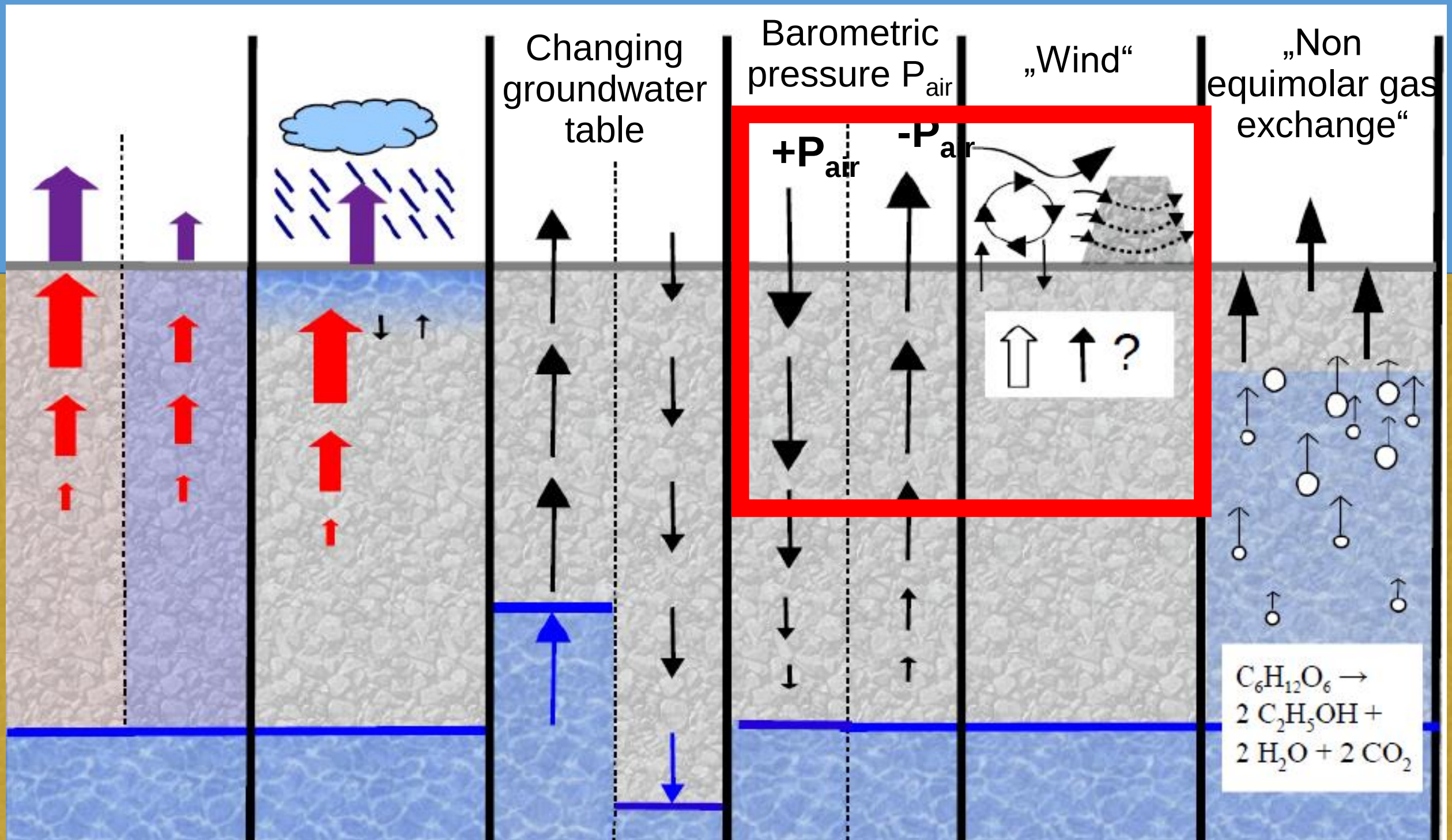
Blowing in the wind: An overview on wind and air- pressure-related effects on soil gas transport

Martin Maier^{1*}, L.Osterholt¹, D. Schindler;

¹Forest Research Institute FVA Baden Württemberg, Freiburg, Germany ;
Chair of Environmental Meteorology, University of Freiburg, Freiburg, Germany







Barometric pumping

„Wind induced-effects“

Barometric pressure P_{air}

Zoom

Large Amplitude P_{air}

Small Amplitude P_{air}

Frequency “low” (>hours)

Frequency higher (10-100s)

*Clements and Wilkening 1974

1D Piston Flow

(Main) Factors:

- Air-filled pore space,
- depth to groundwater/bedrock

What are the processes ?

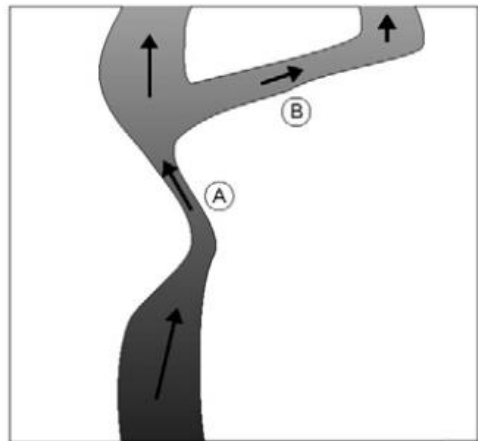
- a) **at the soil-atmosphere interface**
- b) **in the soil**
- c) **In the atmosphere**

„Wind induced-effects“

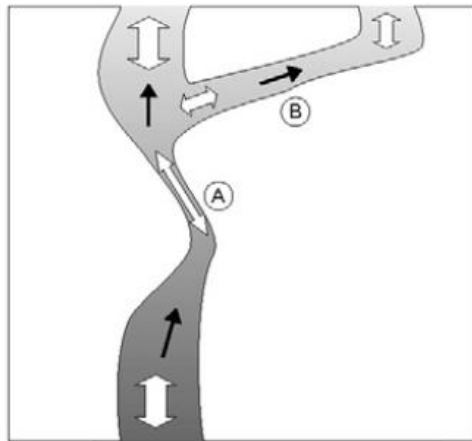
Experimental data example:
Novak et al 2000a,b

Concept: Laemmel et al 2019

No air pressure fluctuation
→ pure diffusion



Oscillating airflow due to
pressure-pumping



low
CO₂ concentration
high

→ Diffusion
↔ Oscillating advection

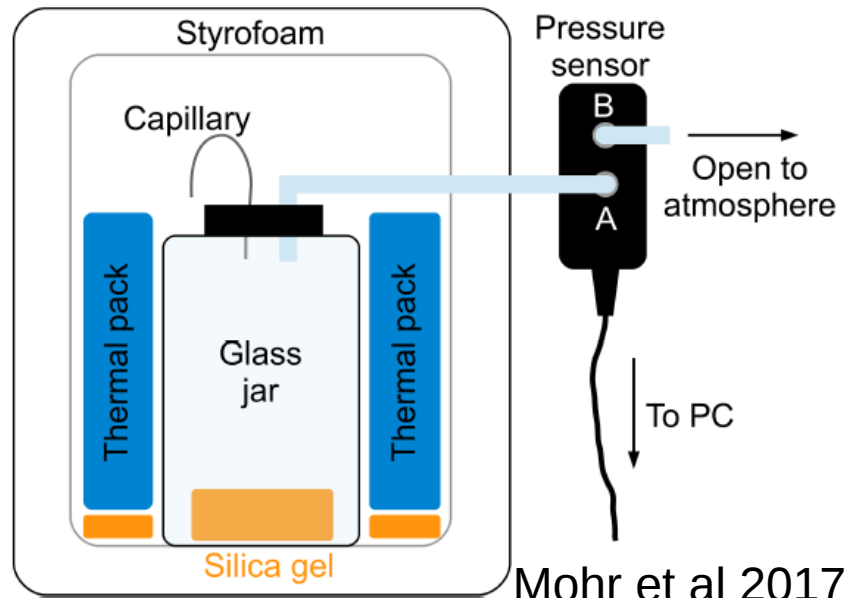
Super Zoom
To pores scale



What are the processes ?

- a) at the soil-atmosphere interface
- b) in the soil
- c) In the atmosphere

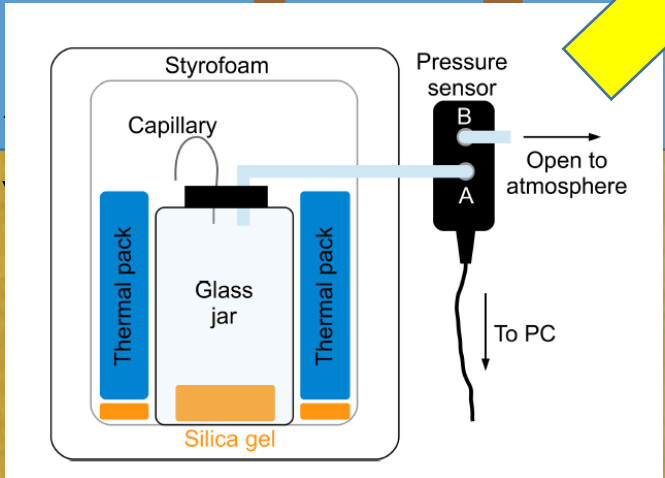
Mohr et al 2016, 2017



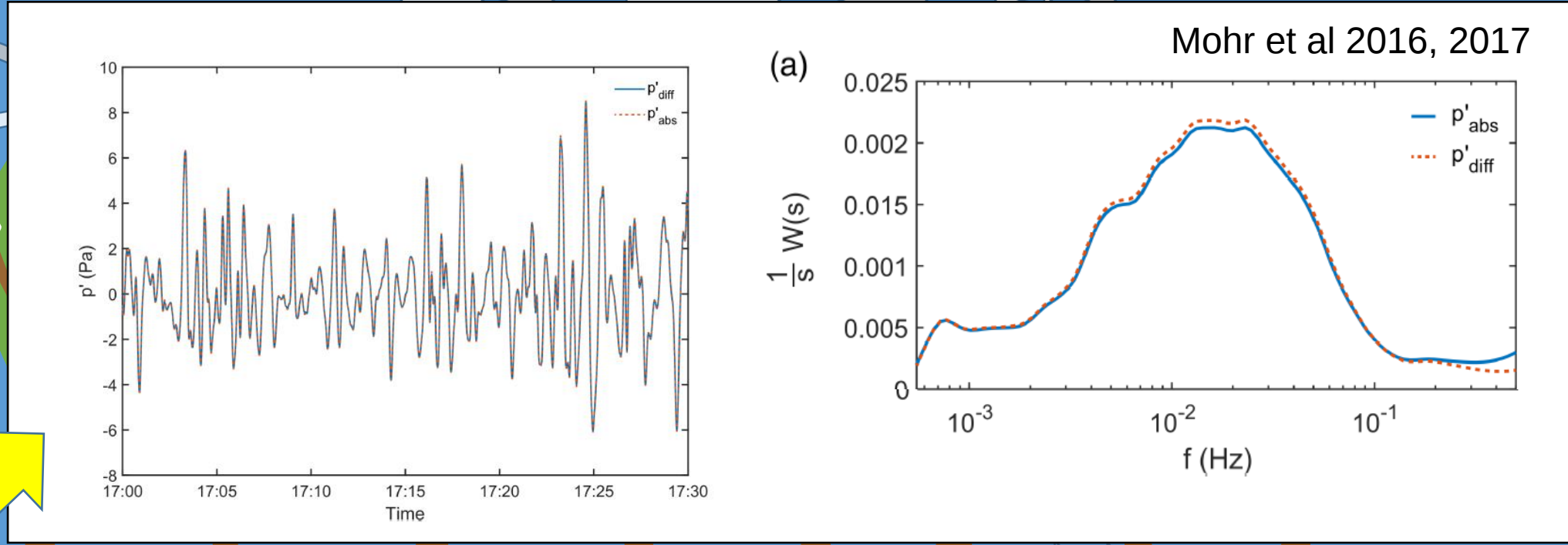
Mohr et al 2017

What are the processes ?

- a) at the **soil-atmosphere** interface
- b) in the soil
- c) **In the atmosphere**

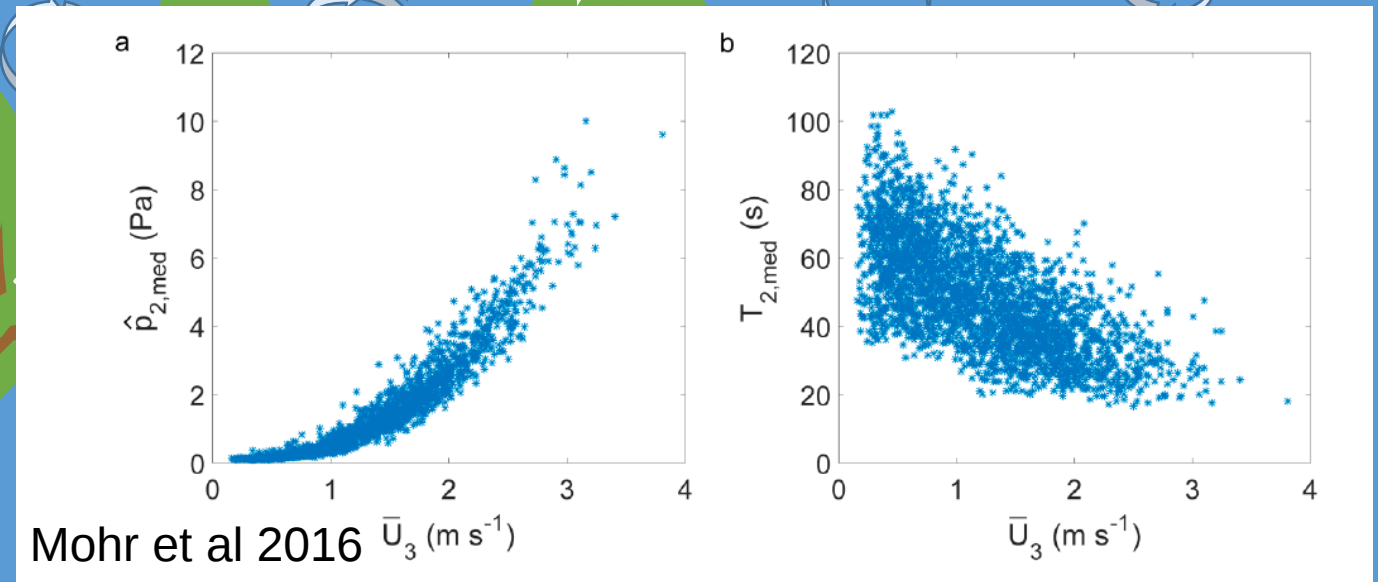
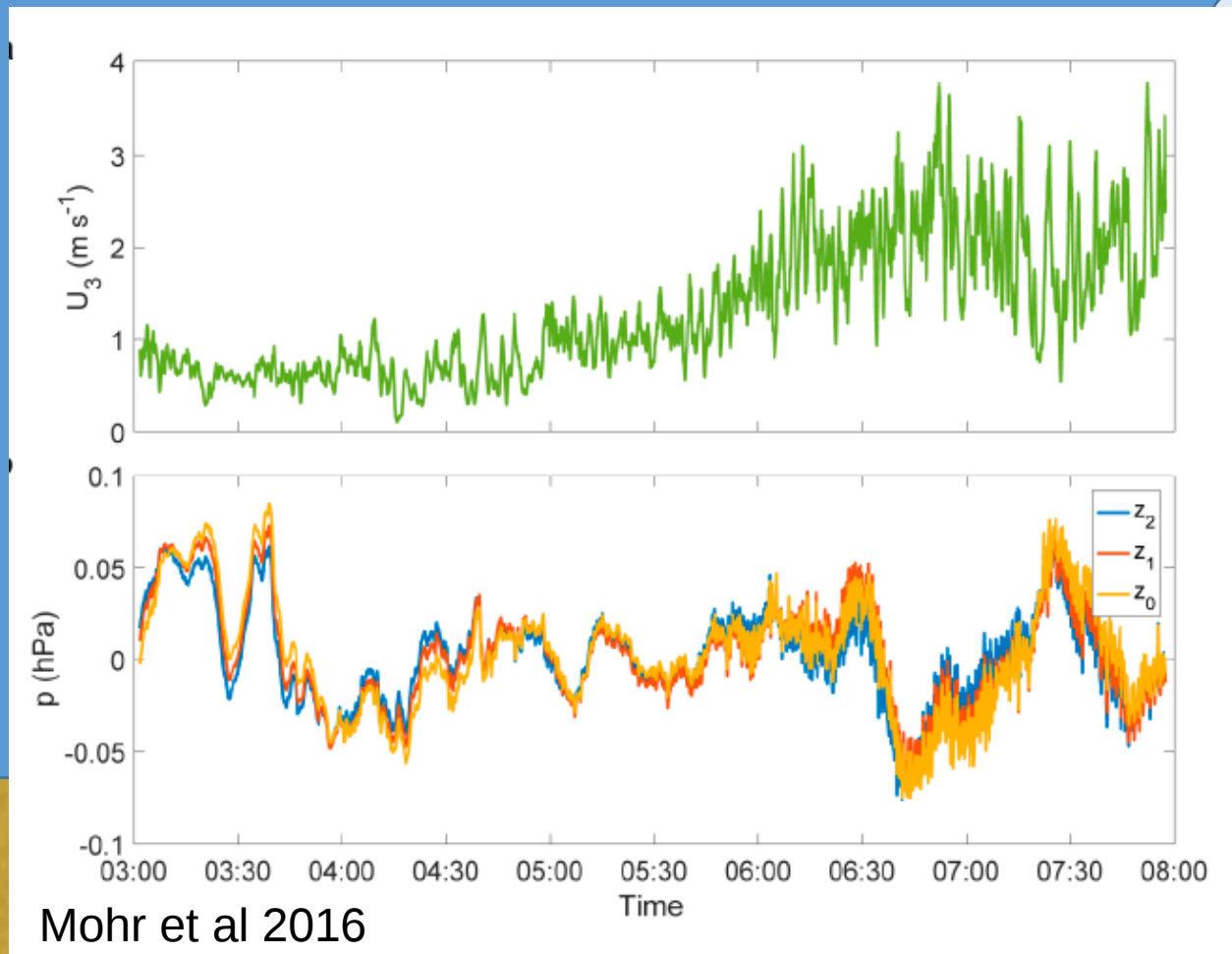


Mohr et al 2017



What are the processes ?

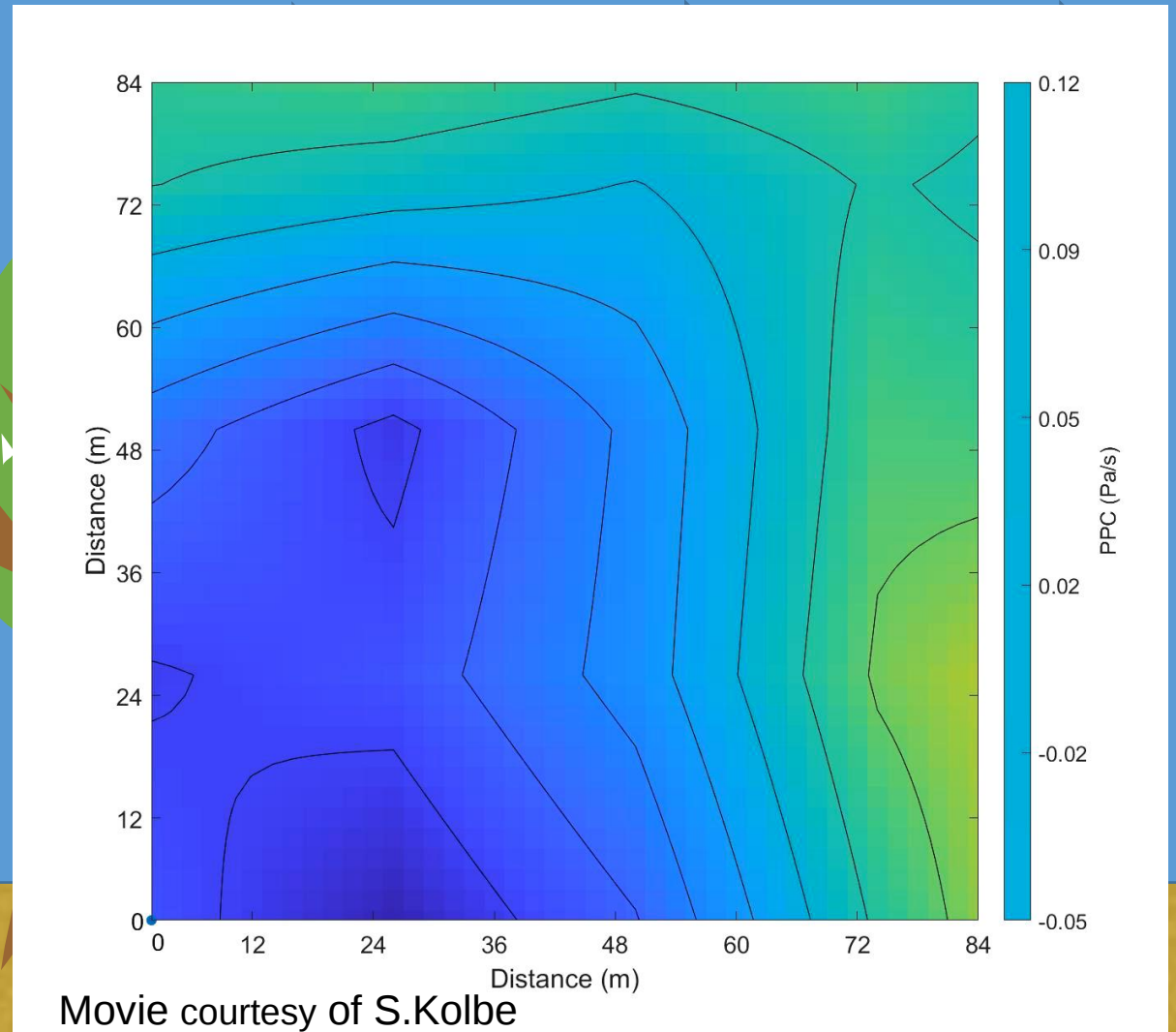
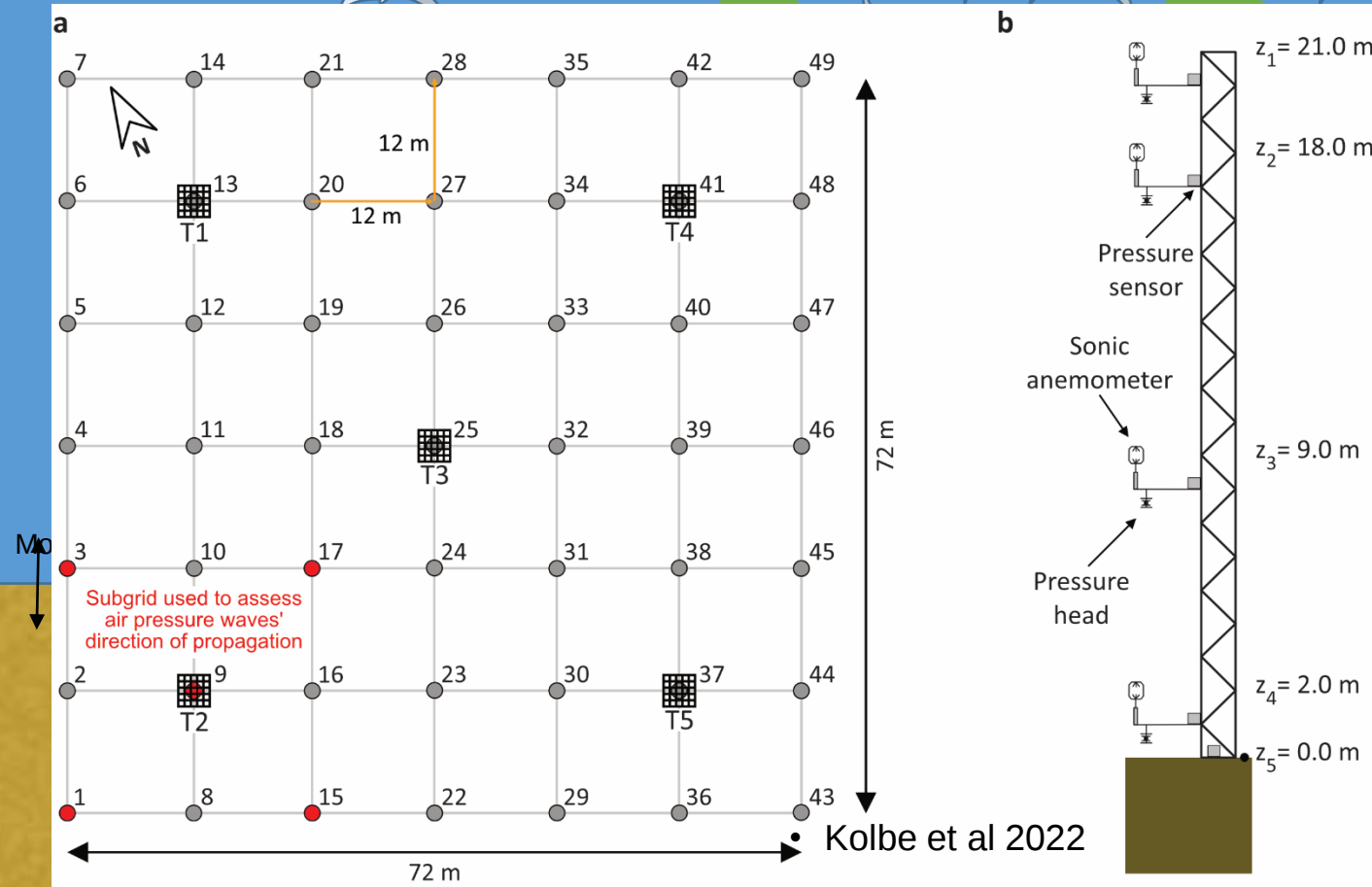
- a) at the **soil-atmosphere** interface
- b) in the soil
- c) **In the atmosphere**



What are the processes ?

- **In the atmosphere**

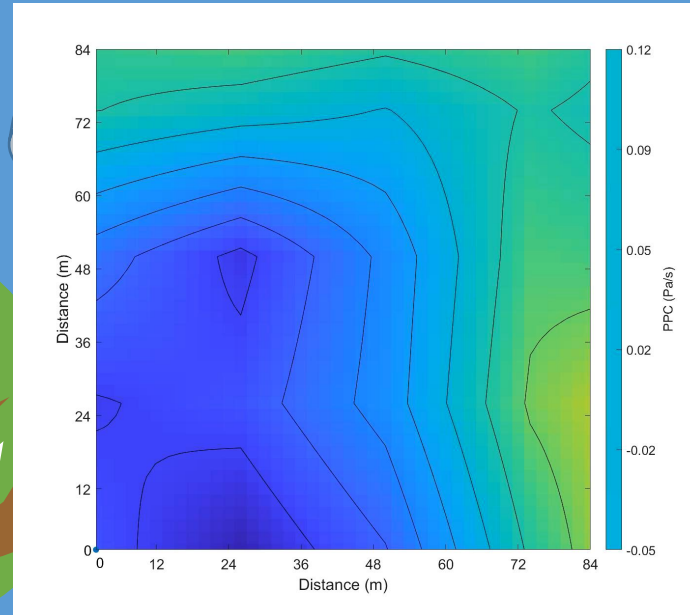
How does the wind generated pressure field move over a forest stand?



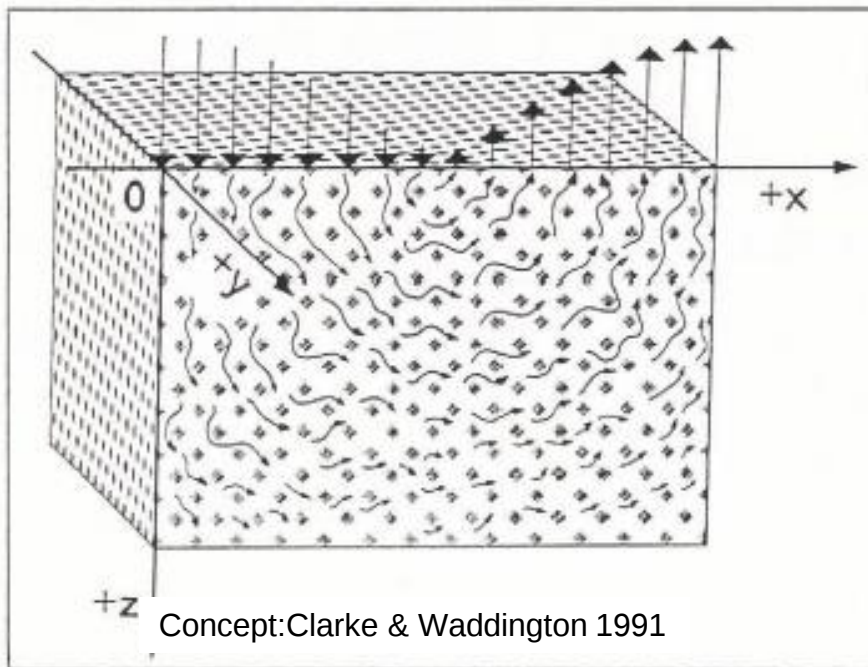
Pressure fields move in the direction and with the speed of the wind above the canopy (Mohr et al 2017)

- What are the processes ?
- In the atmosphere

Mohr et al 2016, 2017



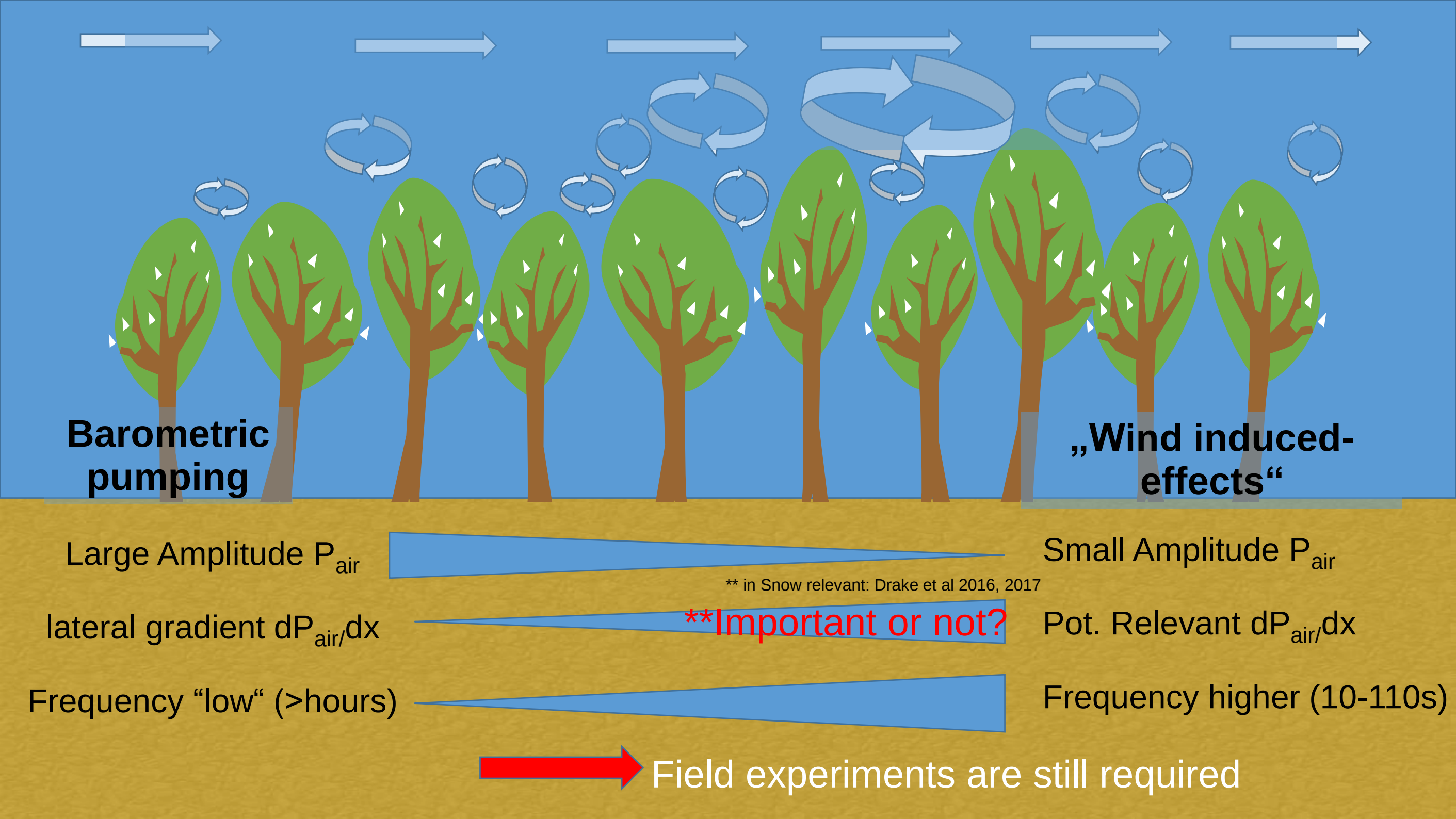
What means a moving pressure field for pressure gradients and flow of air in the soil?



Concept: Clarke & Waddington 1991

What are the processes ?

- **In the atmosphere**





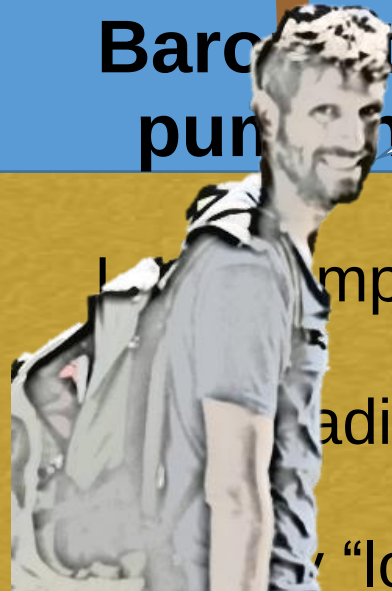
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Thank you
very much for
your attention!

Baroclinic
pumping

„Wind induced-
effects“



Amplitude P_{air}

Small Amplitude P_{air}

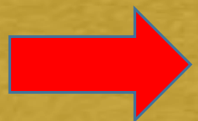
Gradient dP_{air}/dx

****Important or not?**

Pot. Relevant dP_{air}/dx

“low“ (>hours)

Frequency



Field experiments are still required



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