Stratocumulus Clouds at the West Coast of South America: Observations of Diurnal and Seasonal Cycle

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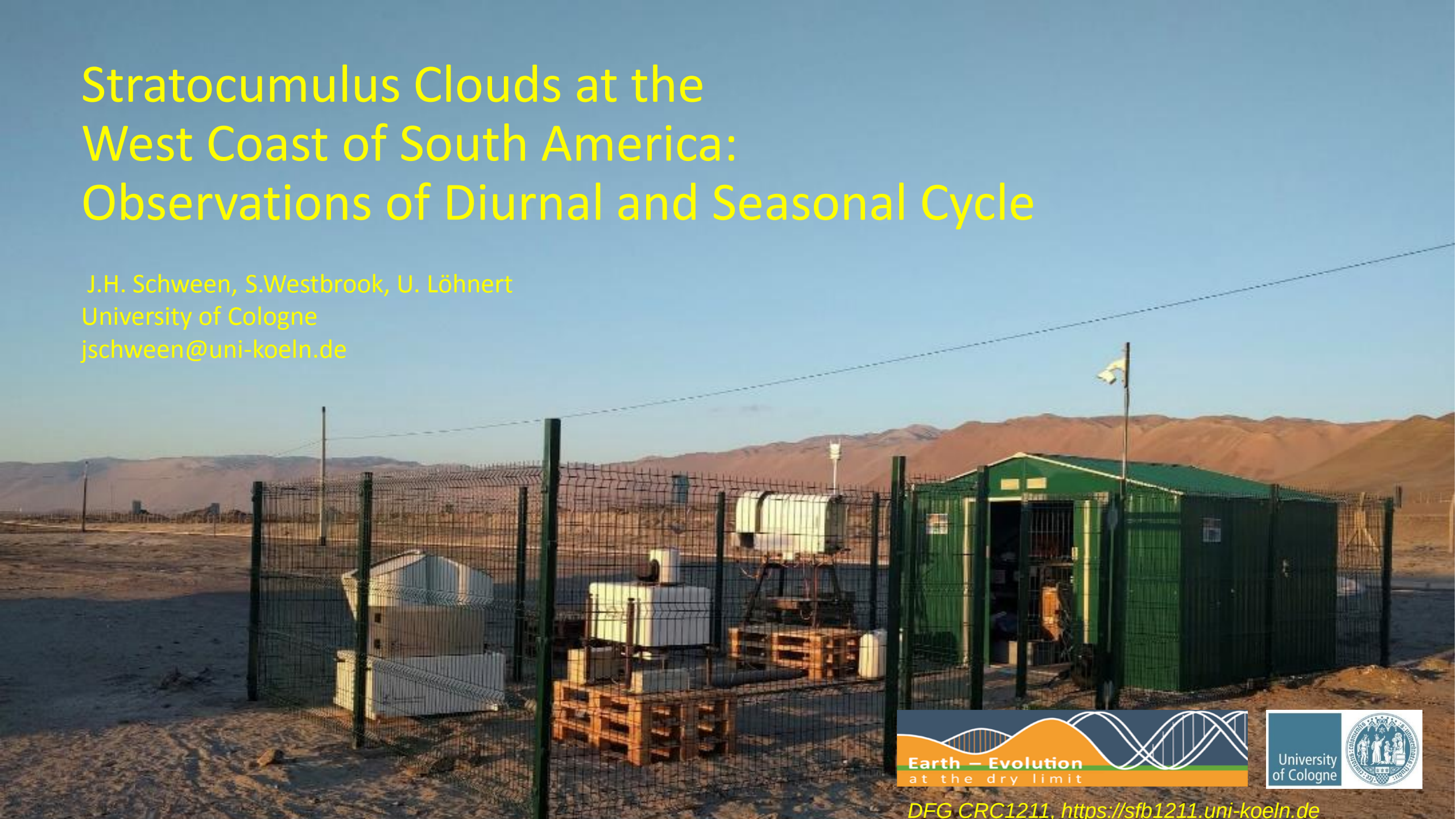


Earth – Evolution at the dry limit

University of Cologne

DFG CRC1211, https://sfb1211.uni-koeln.de

Motivation

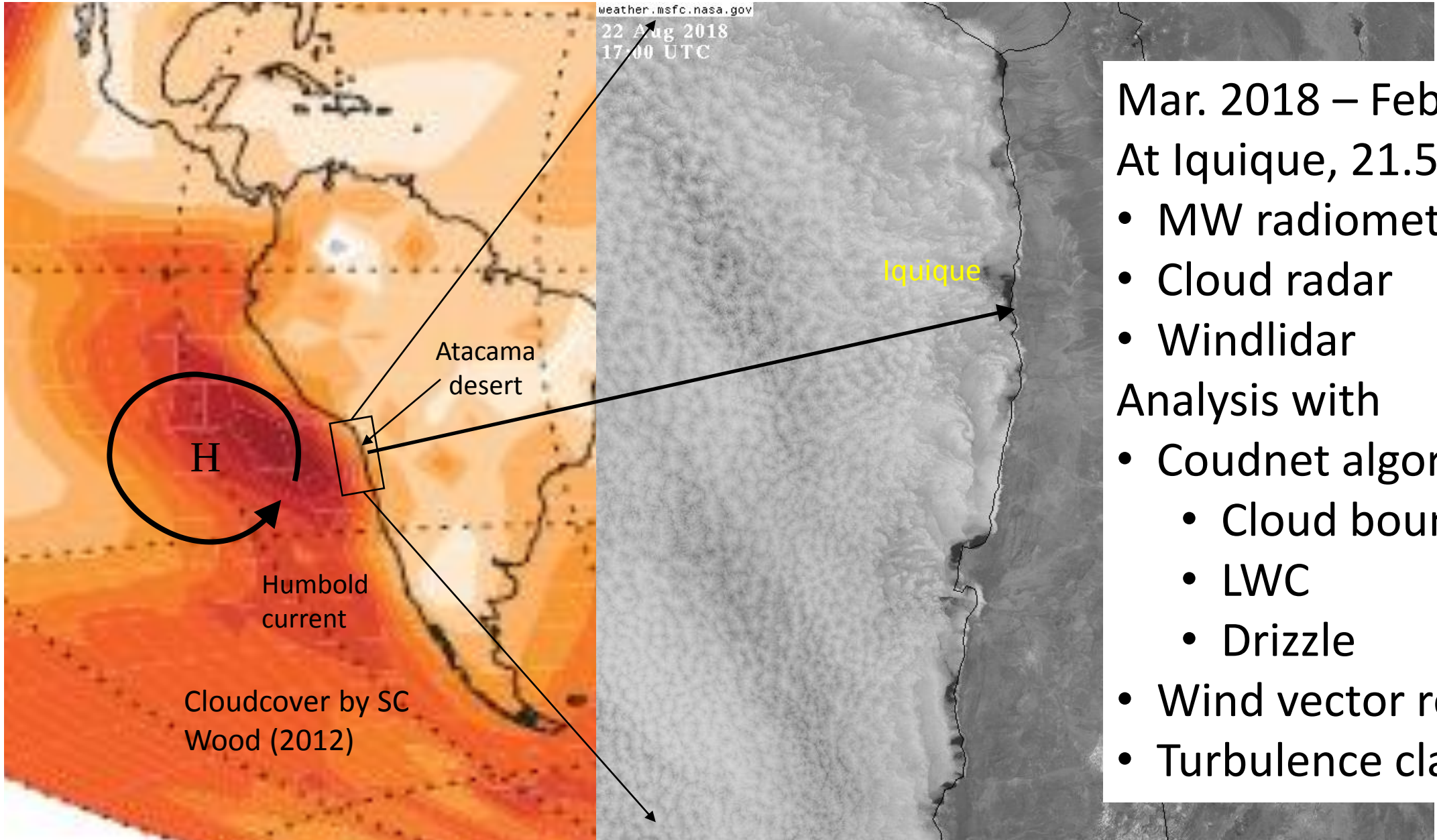
- Stratocumulus cover large areas along the western coast of continents -> important for radiation budget of the planet
- Provide water to coastal desert (Namib, Atacama) or dry areas (California)
- Up to now no continous observations of vertical structure , dynamics, thermodynamics and microphysics
- Objective: understand seasonal and diurnal cycle, relate to external drivers (SST, synoptic, …)

Work is part of the DFG CRC1211

DFG CRC1211, https://sfb1211.uni-koeln.de

Investigates influence of water on
landscape and biologic development,
in a Hyperarid environment
with focus on Atacama and Namib deserts.

Location



Mar. 2018 – Feb. 2019

At Iquique, 21.5°S, 70°W

- MW radiometer
- Cloud radar
- Windlidar

Analysis with

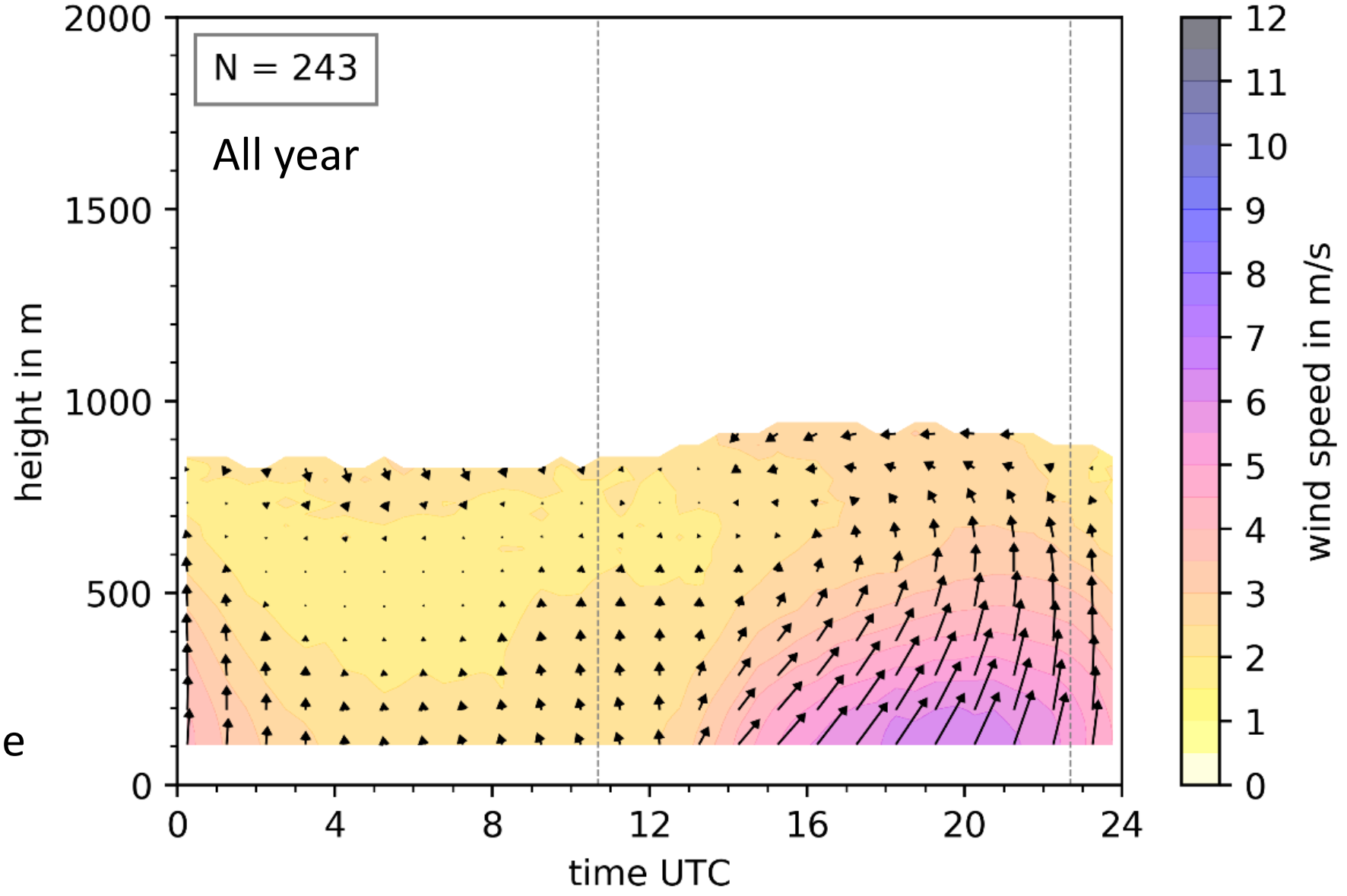
- Coudnet algorithm
  - Cloud boundaries
  - LWC
  - Drizzle
- Wind vector retrieval
- Turbulence classification

wind

Diurnal cycle

Surface wind

- S wind from SE-pacific High-pressure-system, channeling along coast, thermal wind
- E/W component from land-sea-breeze
- => SE wind during day
- => SW wind during night
- Recirculation at cloud base or BL top



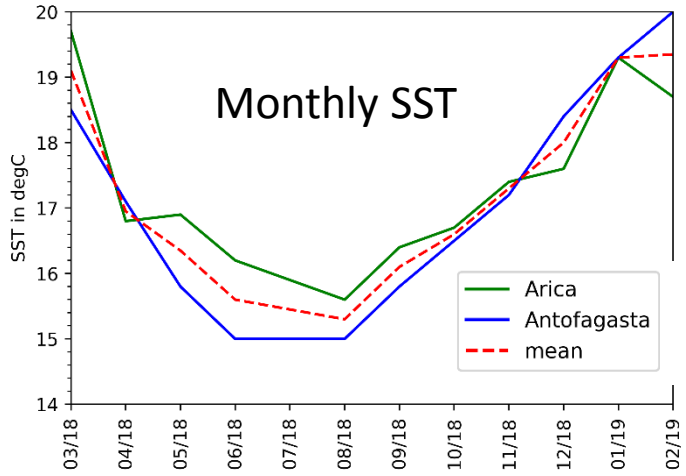
Potential temperature

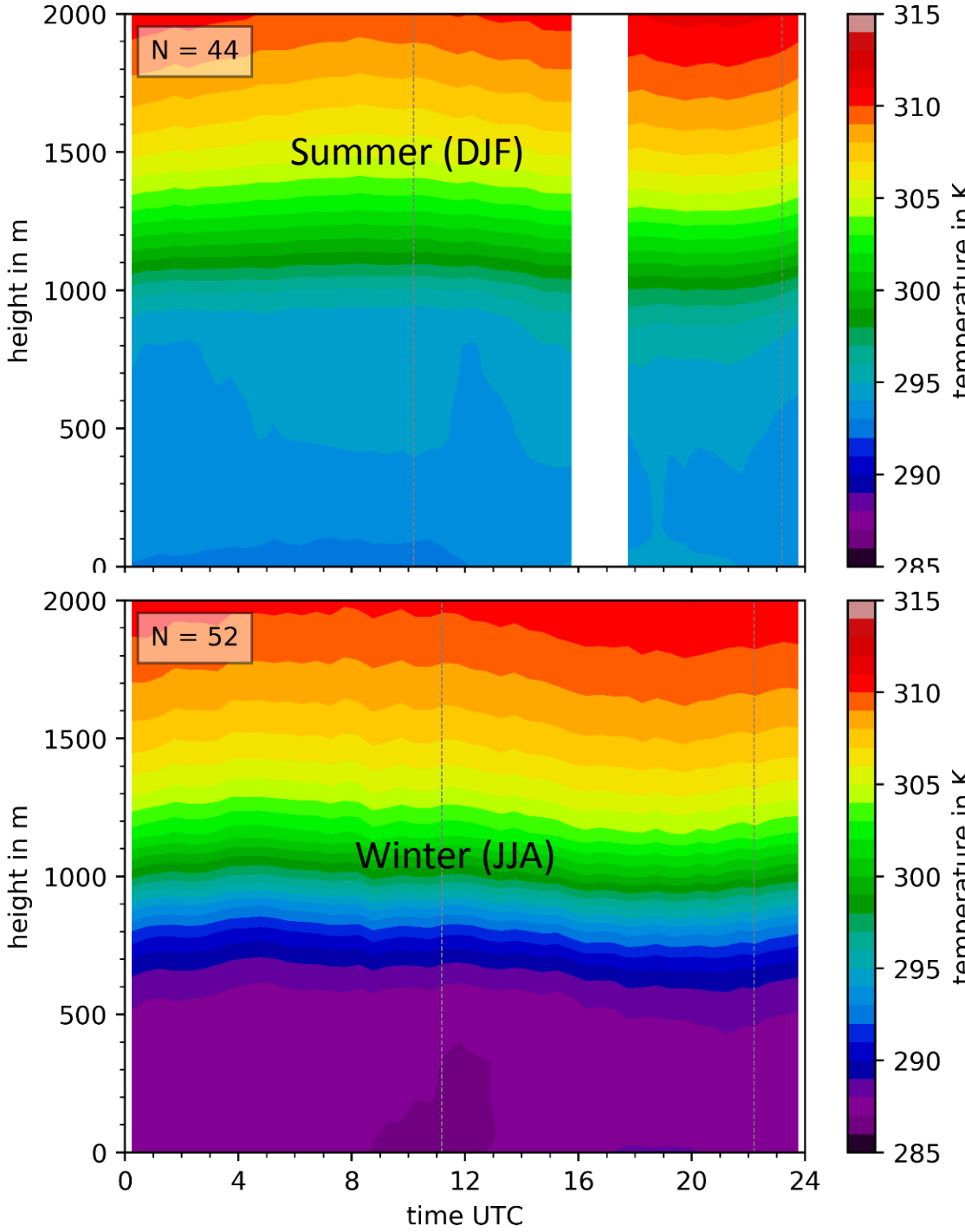
BL higher in Summer

- less clouds, higher sun, higher SST
- H further south
  => less subsidence

Stratification:

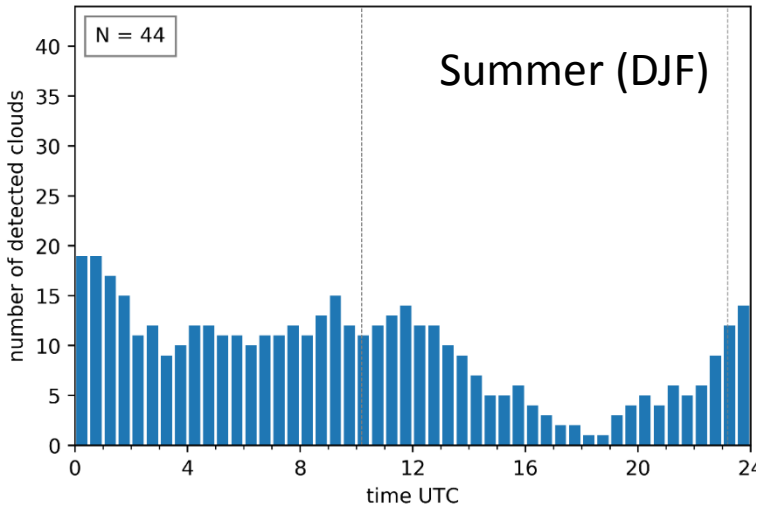
- In summer stable
- In winter neutral
  => more clouds
  => cloud top cooling
  => vertical mixing …

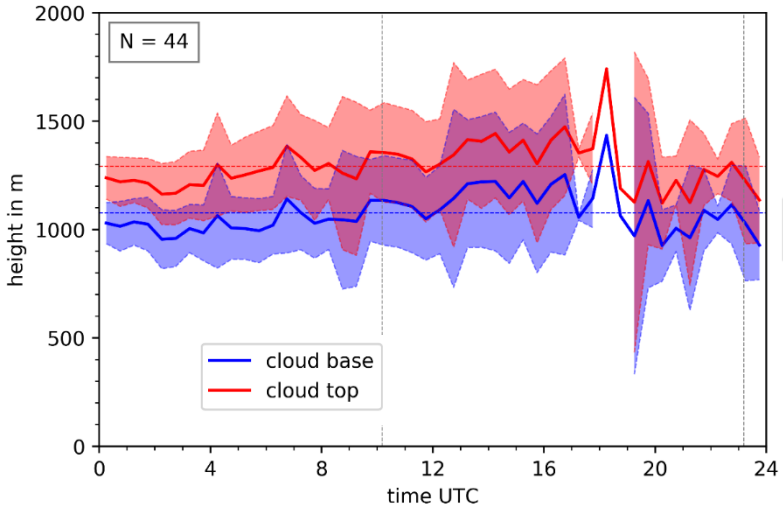


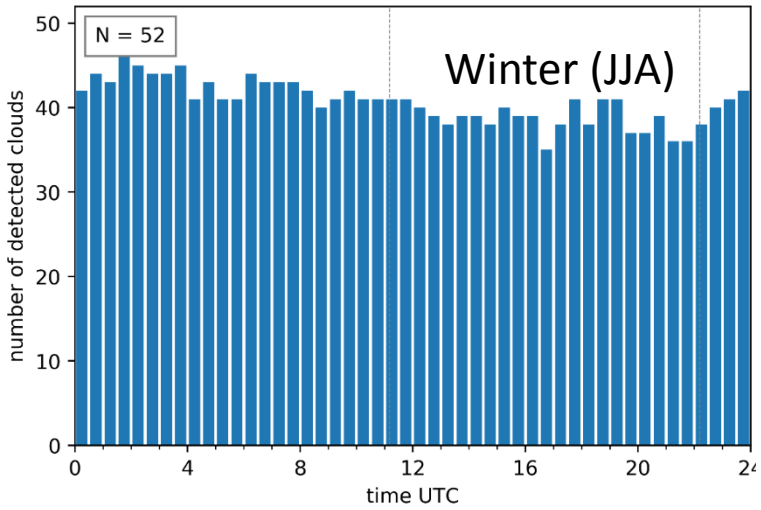


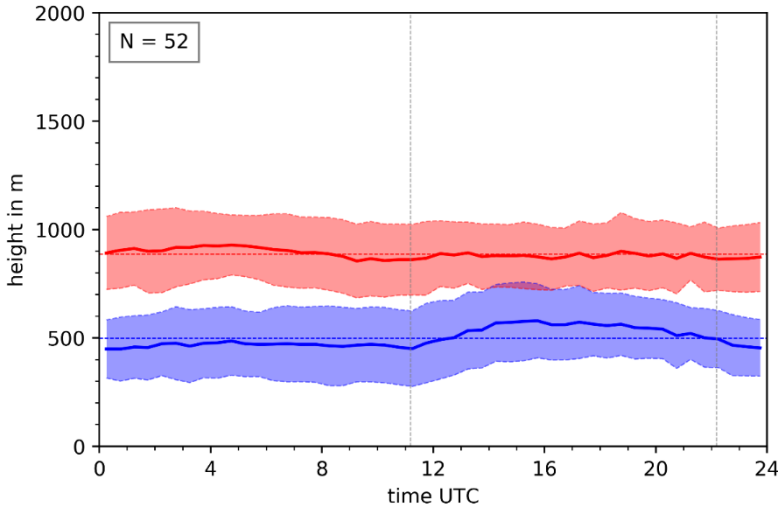
Cloud frequency and heights

- Much less frequent in Summer than in winter
- Higher and more variable in summer
- In winter cloud base higher during daytime
- Cloud top constant
- ⇒Clouds are ‚eaten' from the bottom
- ⇒Sea breeze circulation + surface heating at coastal plain



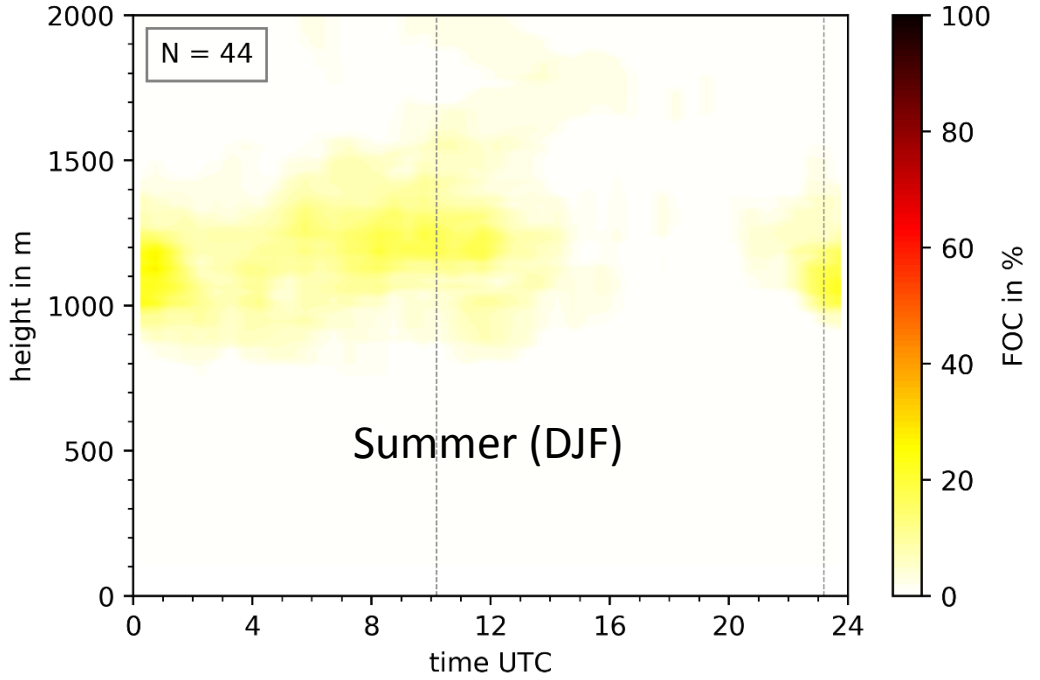


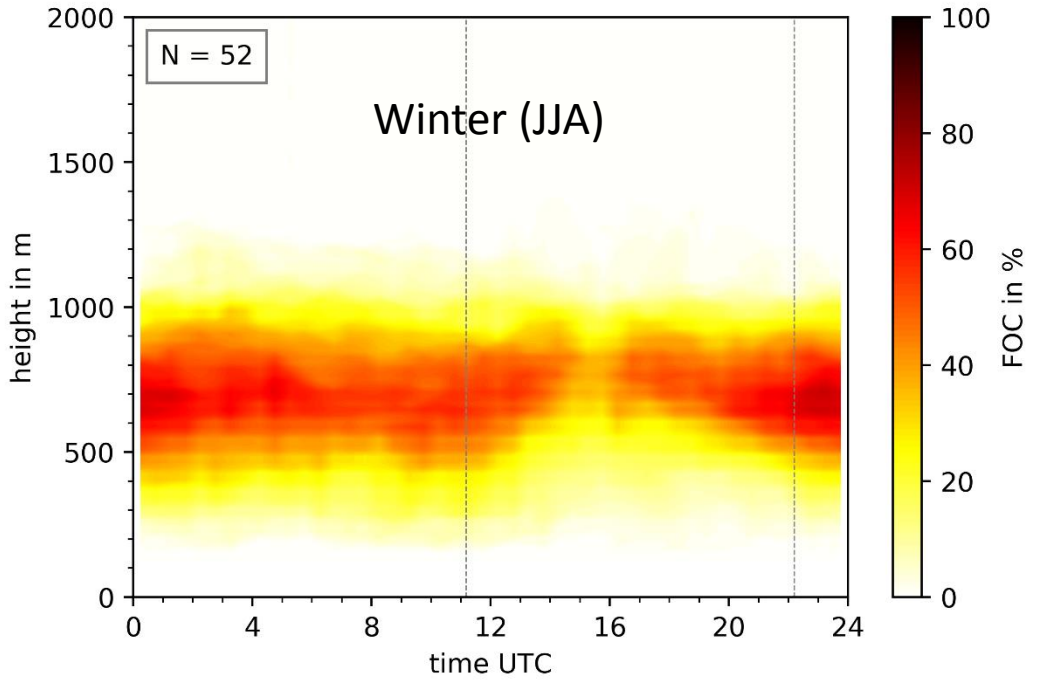




Cloud frequency per dt × dz bins

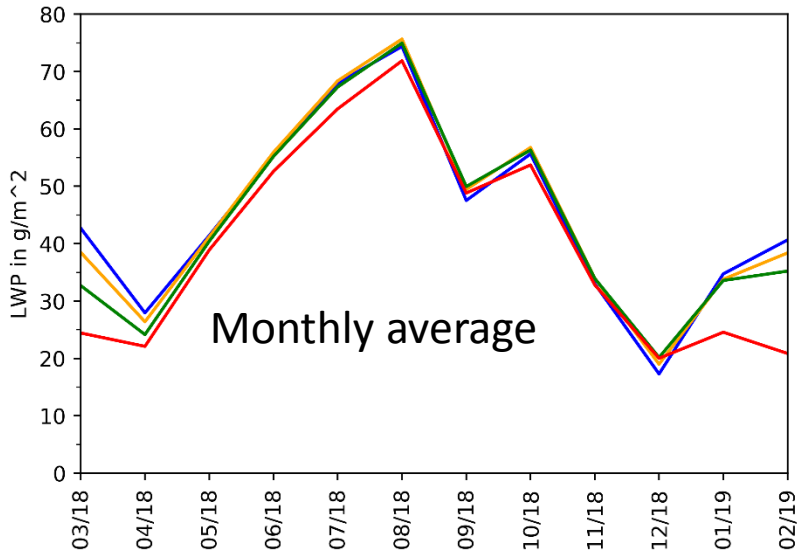
- Much less frequent in Summer than in winter
- Higher and more variable in summer
- In winter cloud base higher during daytime
- Cloud top height +/- constant with a slight decrease during daytime

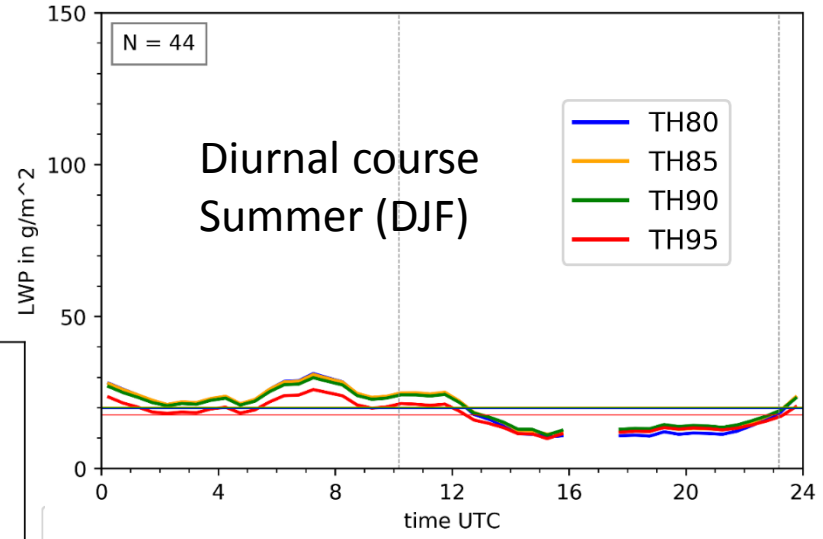


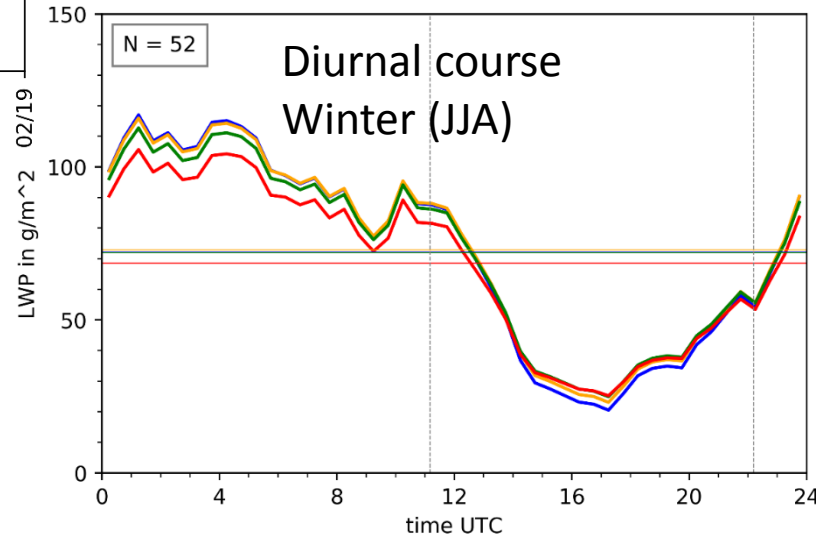


Liquid water path

- Max LWP in winter
- Min LWP in summer
- Largest daily amplitude in Winter with max in first half of night

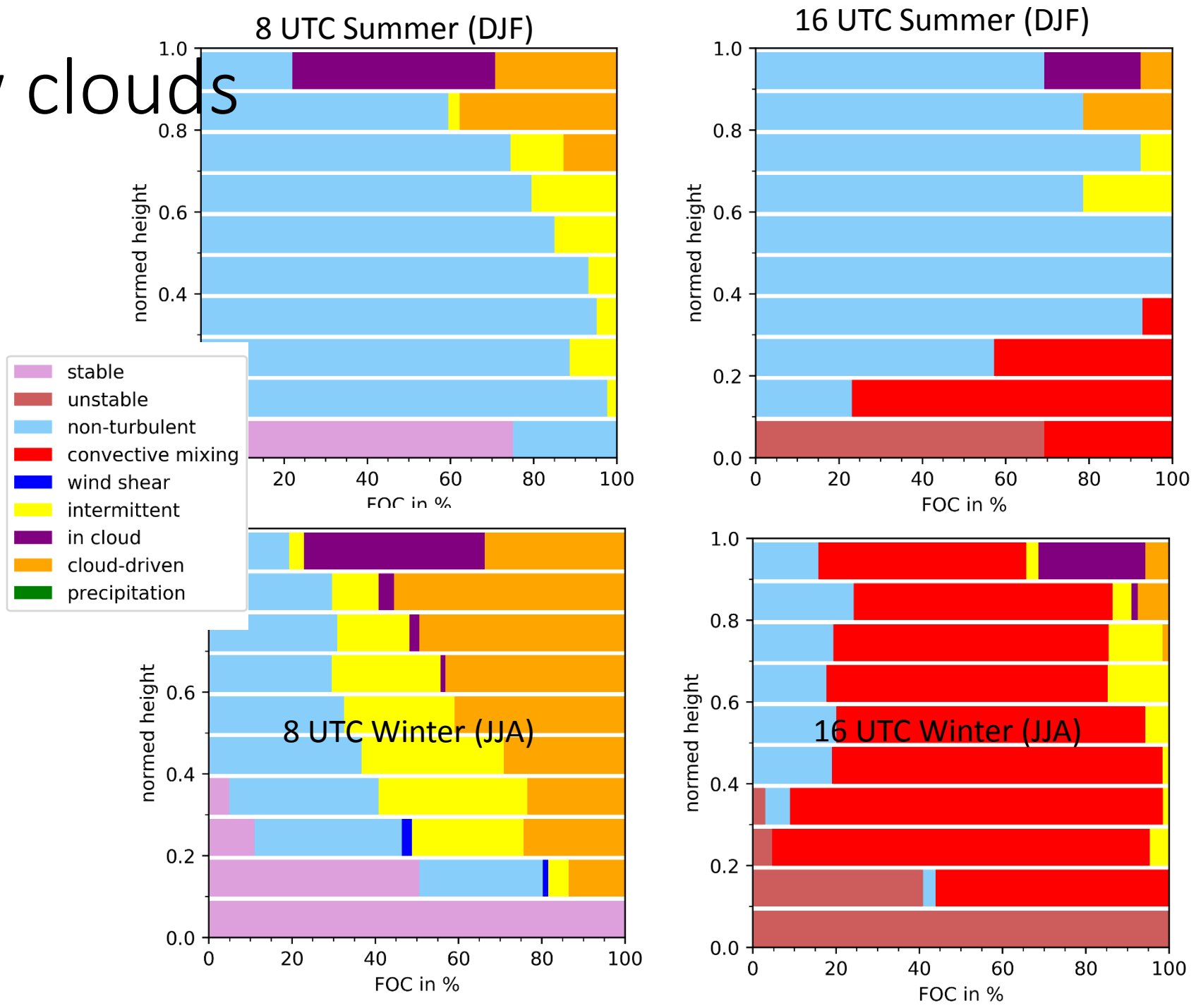






Turbulence below clouds

- cloud driven turbulence is shallow in summer and deep in winter nights
- Convective turb. (=surface driven) during daytime Is shallow in summer and deep in winter

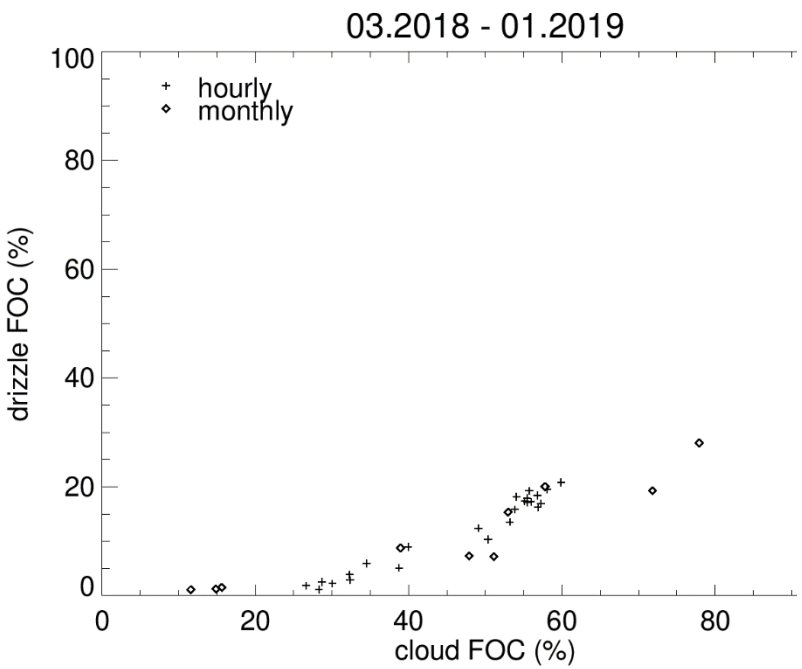


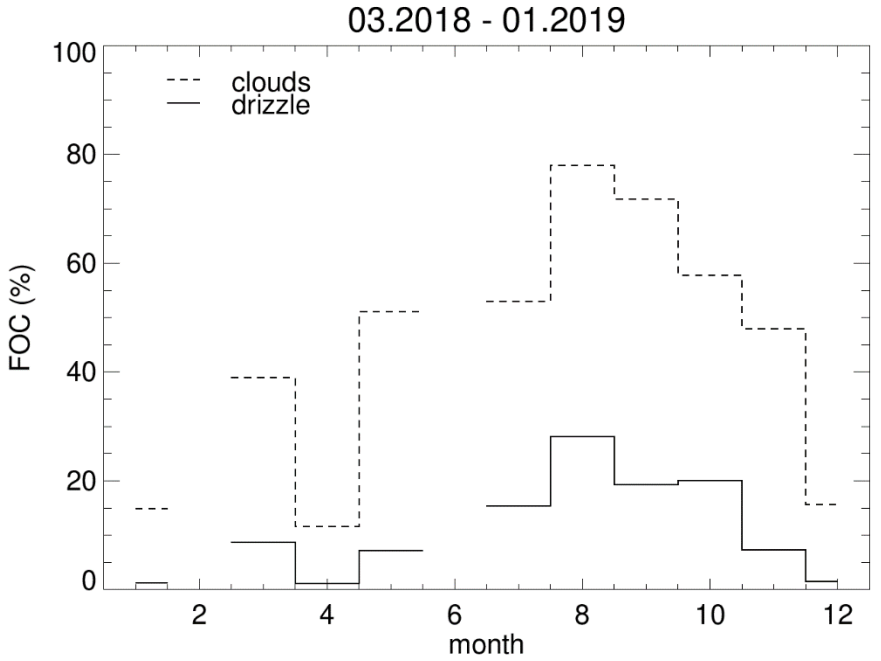
Drizzle: Frequency of occurence

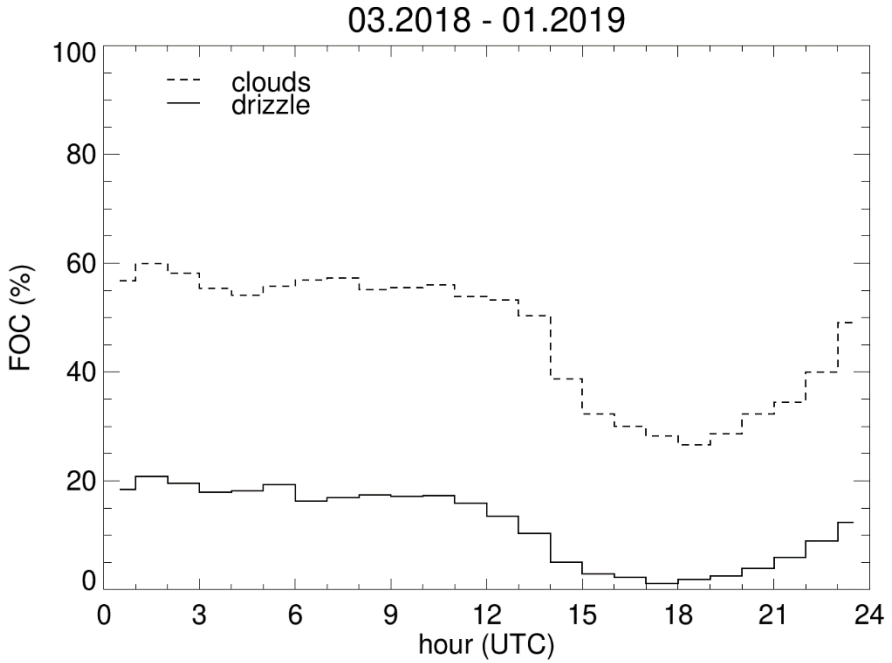
drizzle most frequent in end-summer to spring, nearly no in winter

Most drizzle during night

strongly coupled to foc of clouds







Drizzle and cloud boundaries

drizzle does not reach ground

the lower cloud base and the thicker the cloud the further down reaches the drizzle