

Arcti**C** Amplification: **C**limate Relevant **A**tmospheric and Surfa**C**e Processes, and Feedback Mechanisms (**AC**)³

Welcome

AFLUX—**A**irborne measurements of radiative and turbulent
FLUXes of energy and momentum in the Arctic boundary layer

18 March 2019

Longyearbyen, Spitzbergen



<http://ac3-tr.de/>

+ DLR + LaMP

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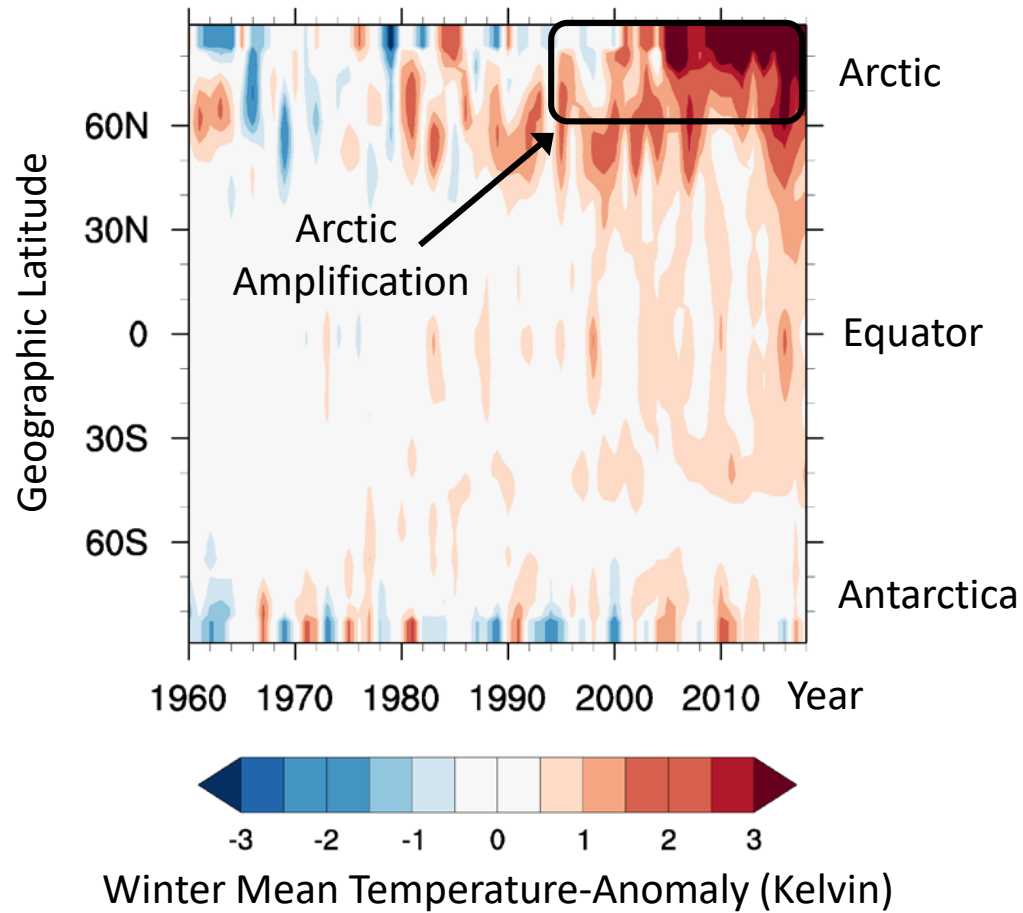
Clouds over Fram Strait.

1. Why are we here?
2. What do we want to do?
3. How do we organize ourselves?

ACLOUD 2017 campaign with Polar 5 & 6.

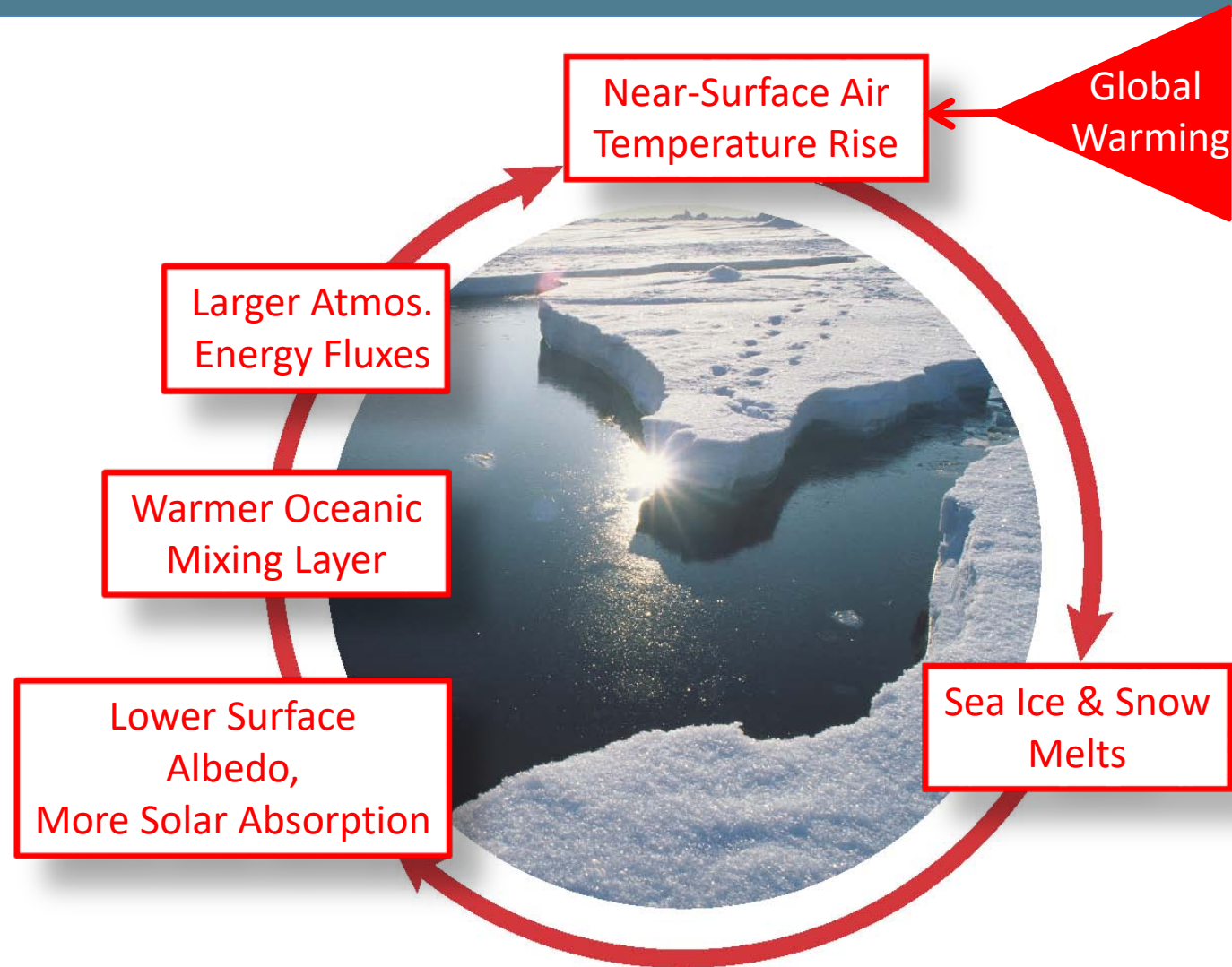


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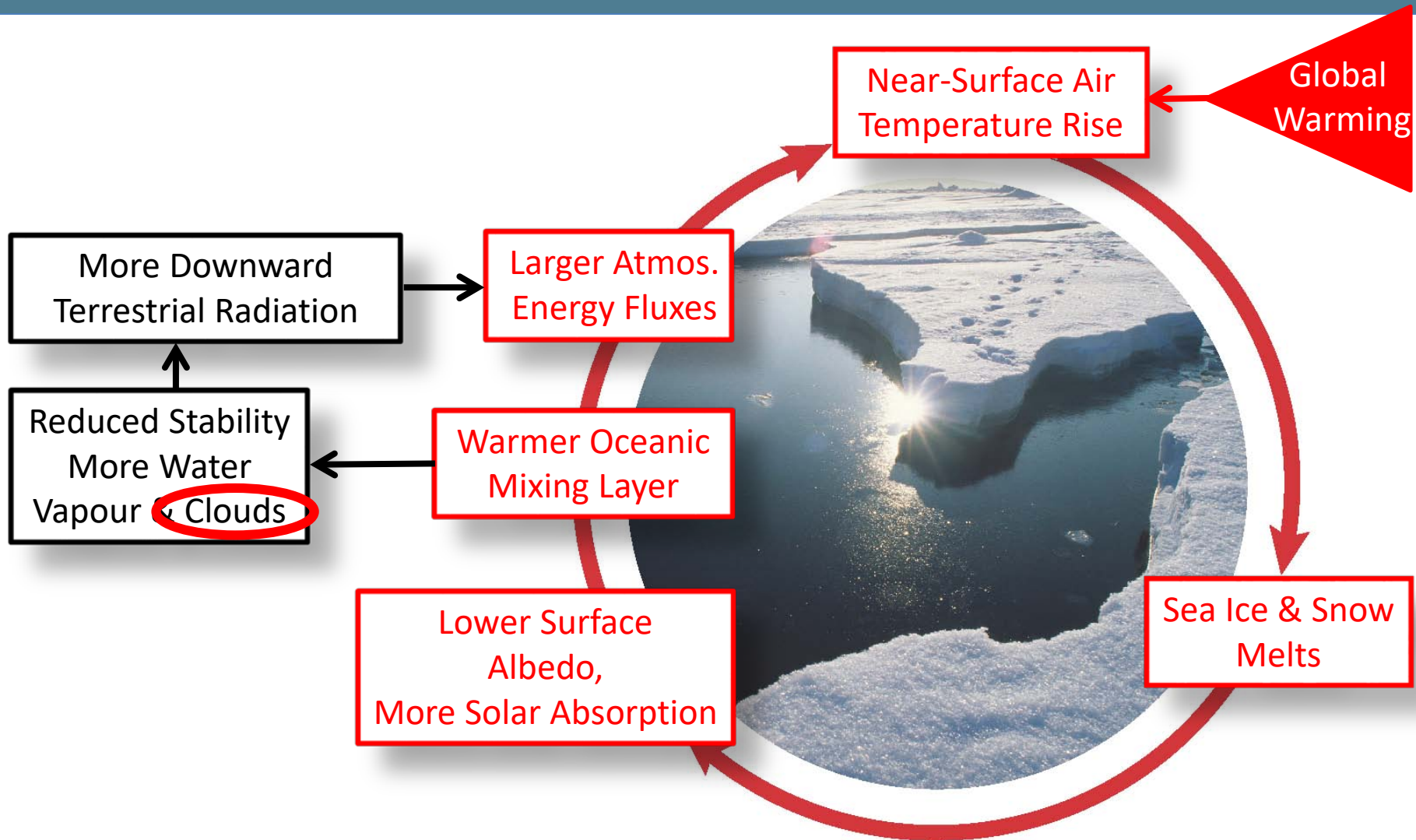
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Wendisch et al. (2017)

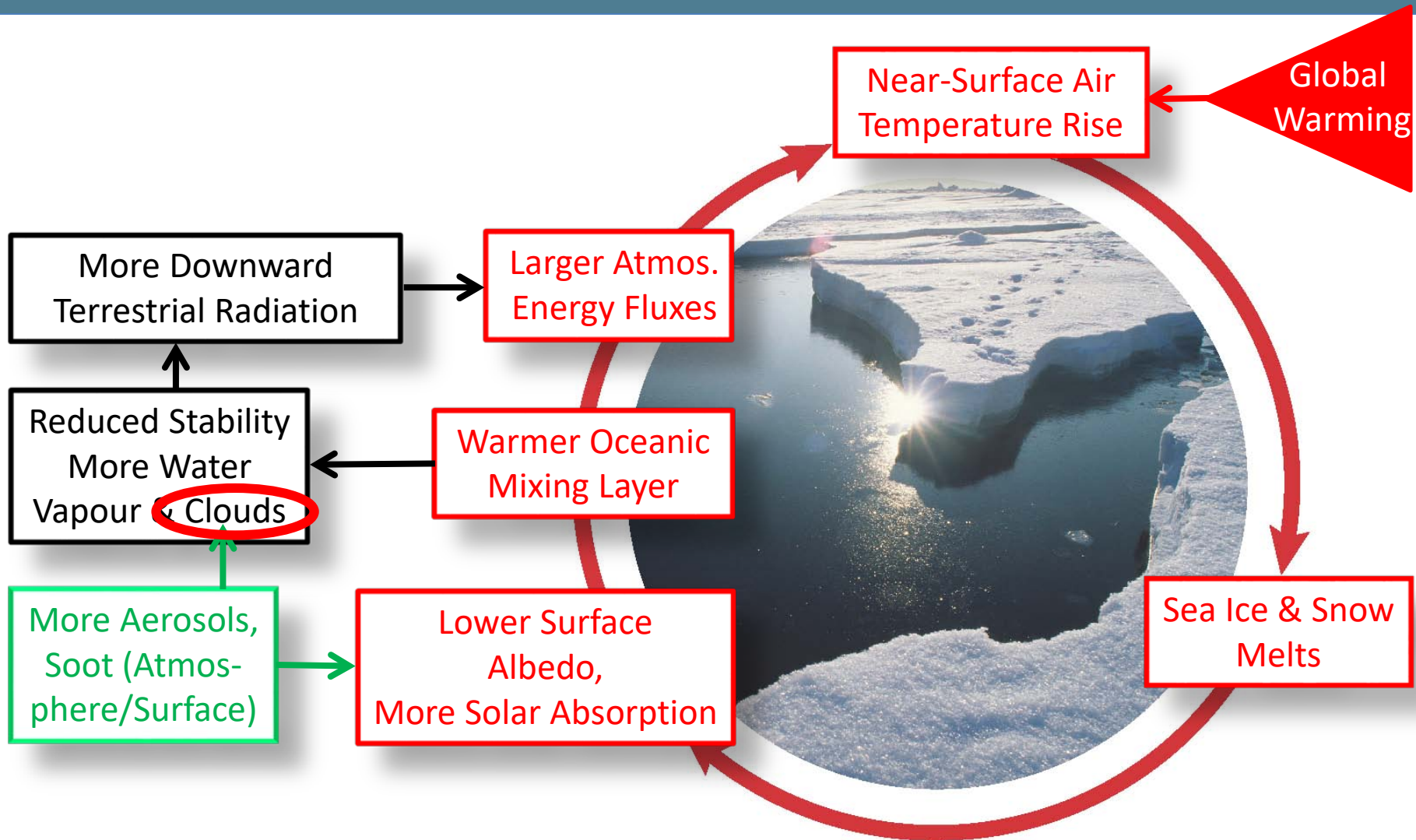
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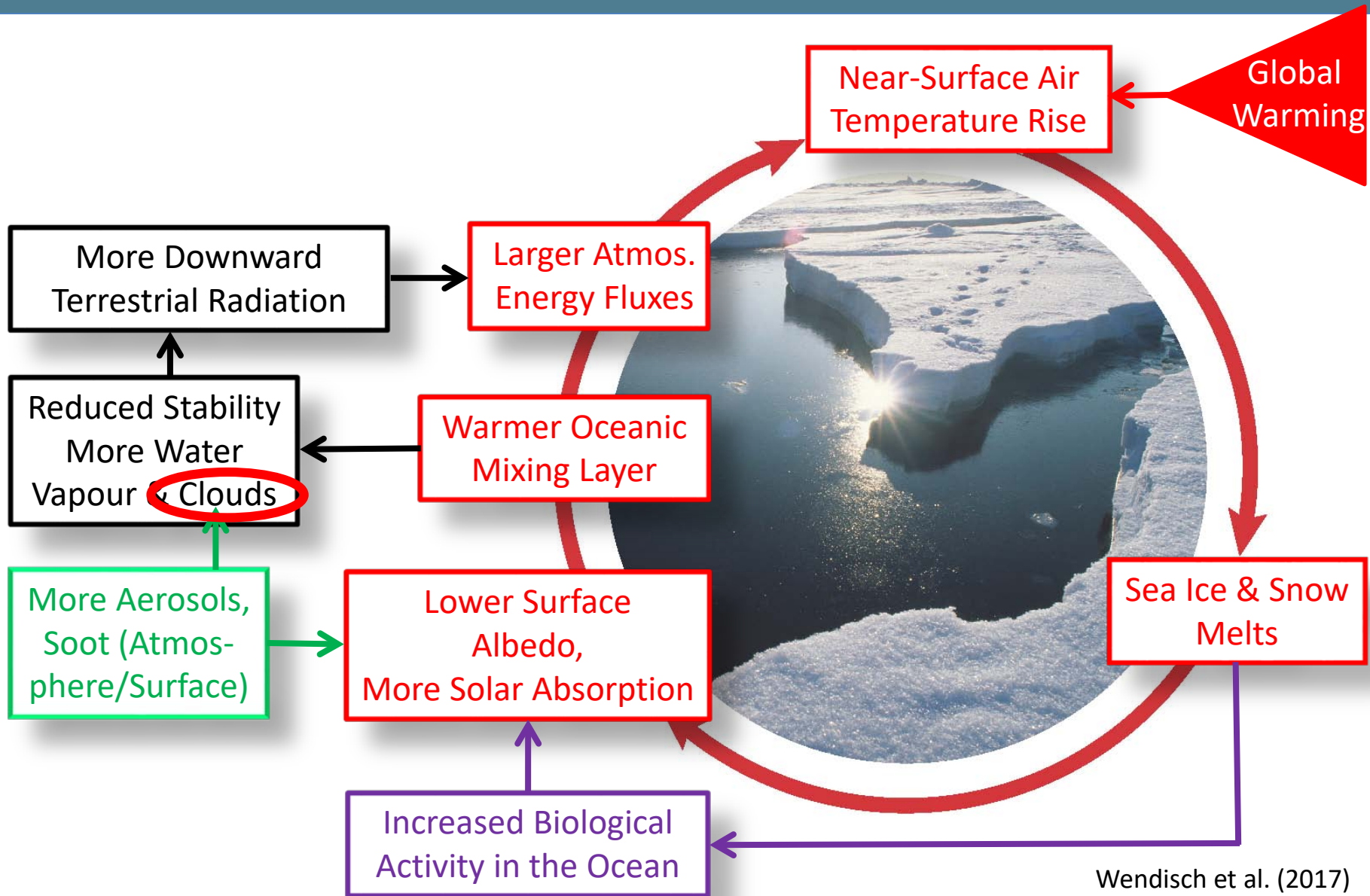
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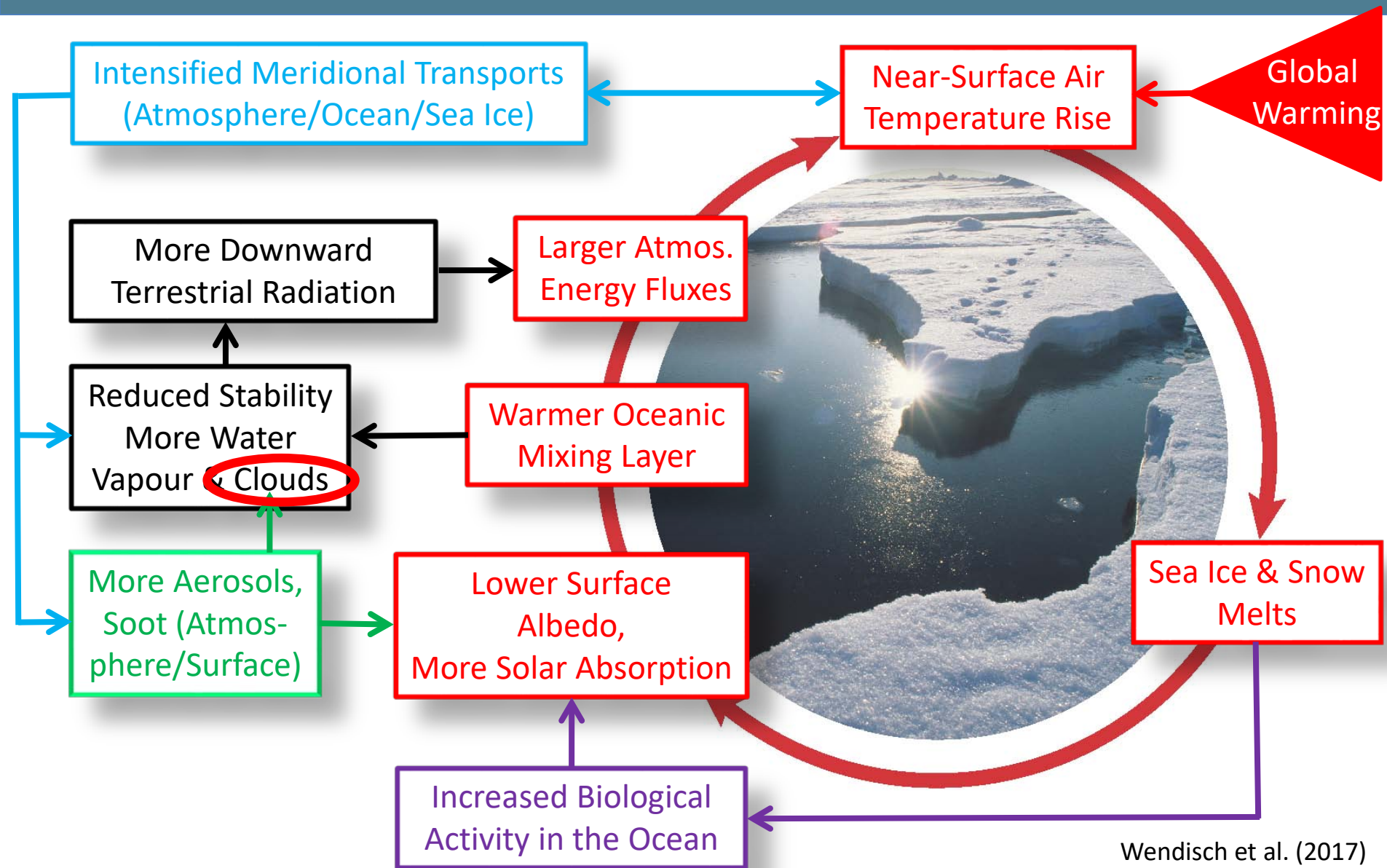
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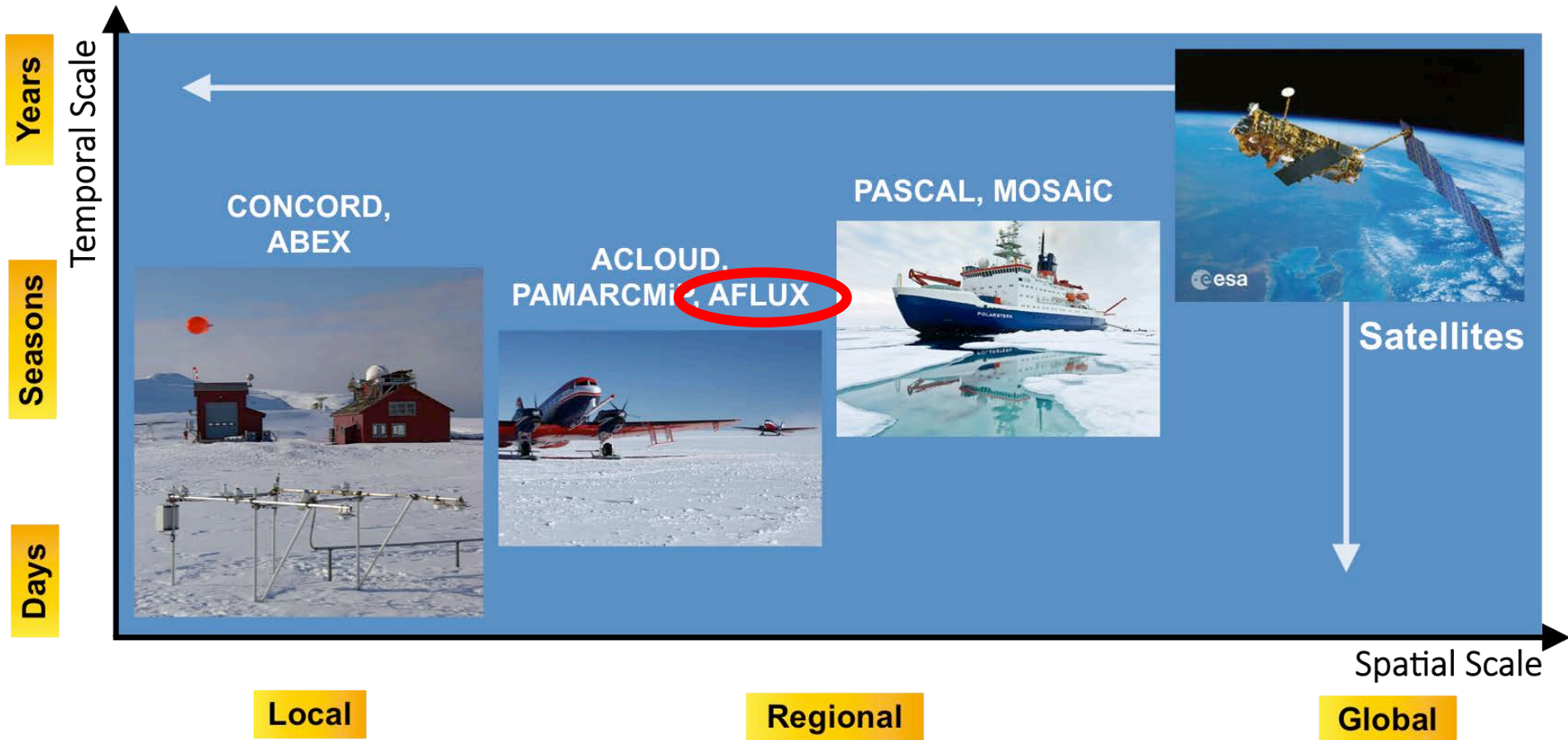
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1. Why are we here?

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General

Continue/intensify/extend process studies using observations and model hierarchy

Phase I

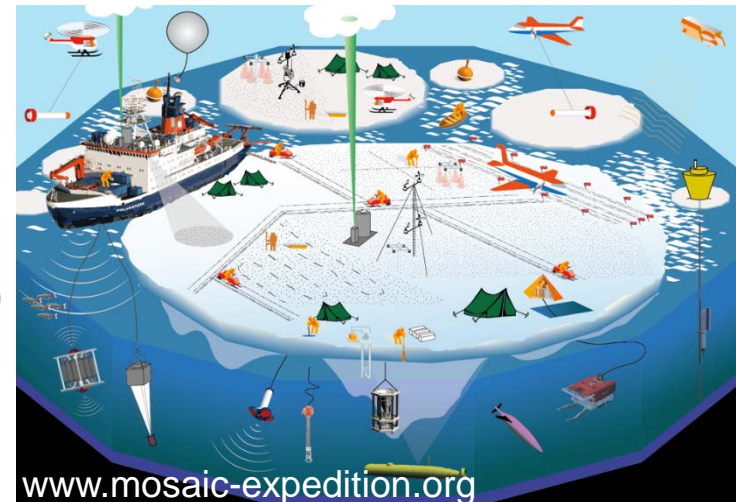
- Atmosphere & atmosphere-surface interactions
- Short/medium & local/regional scales

Phases II & III

- **Deeper:** Ocean processes
- **Longer:** Seasonal changes
- **Larger:** From local to remote forcings

Observational Tools

- **Deeper & Longer:** MOSAiC (Multidisciplinary drifting Observatory for the Study of Arctic Climate)
- **Larger:** HALO-(AC)³ (High Altitude and Long Range Research Aircraft)



HALO—(AC)³: Sampling of Moving/Transforming Air Masses in the Arctic



Max. flight range: 10,000 km

Max. flight endurance: 10 h

Max. ceiling: 15 km

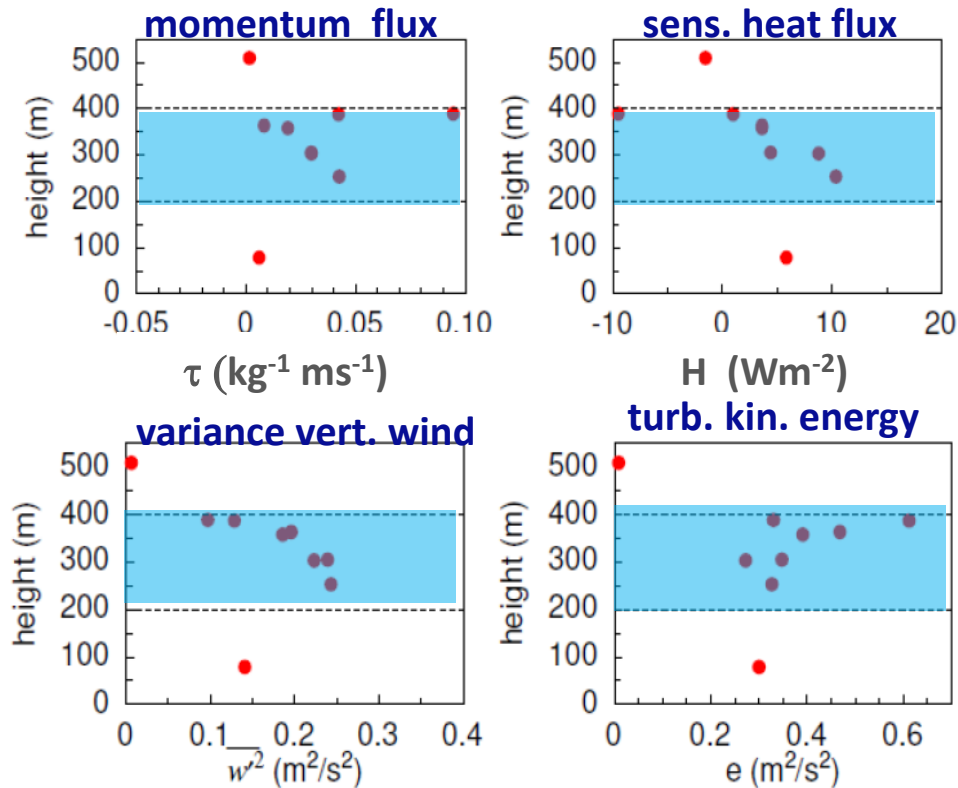


MAX-PLANCK-GESELLSCHAFT



Study the effects of clouds during another season!

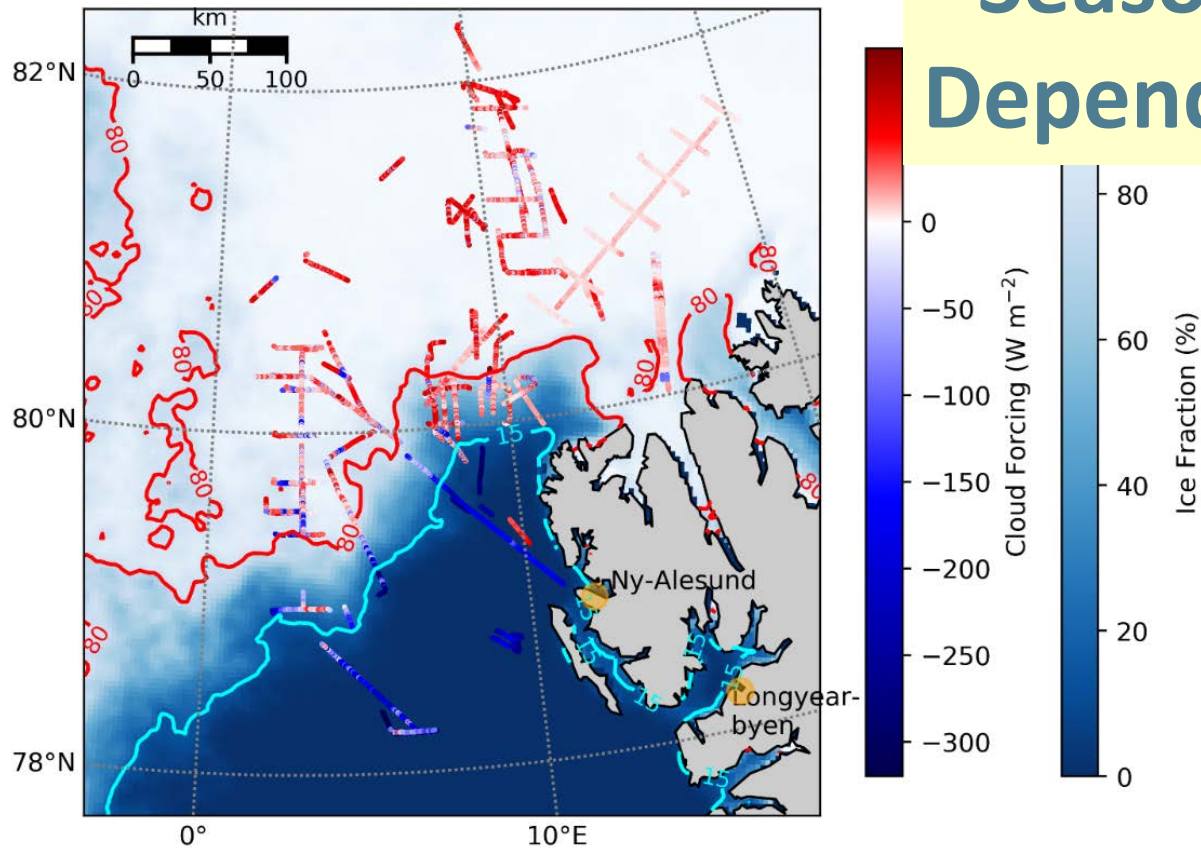
- Cloud and surface generated turbulence
- Effects of clouds and surface on radiation
- Cloud inhomogeneities
(three-dimensional radiative effects)
- Multilayer clouds
- Cloud effects and remote sensing over bright surfaces
- Cloud evolution/persistence



**Seasonal
Dependence ?**

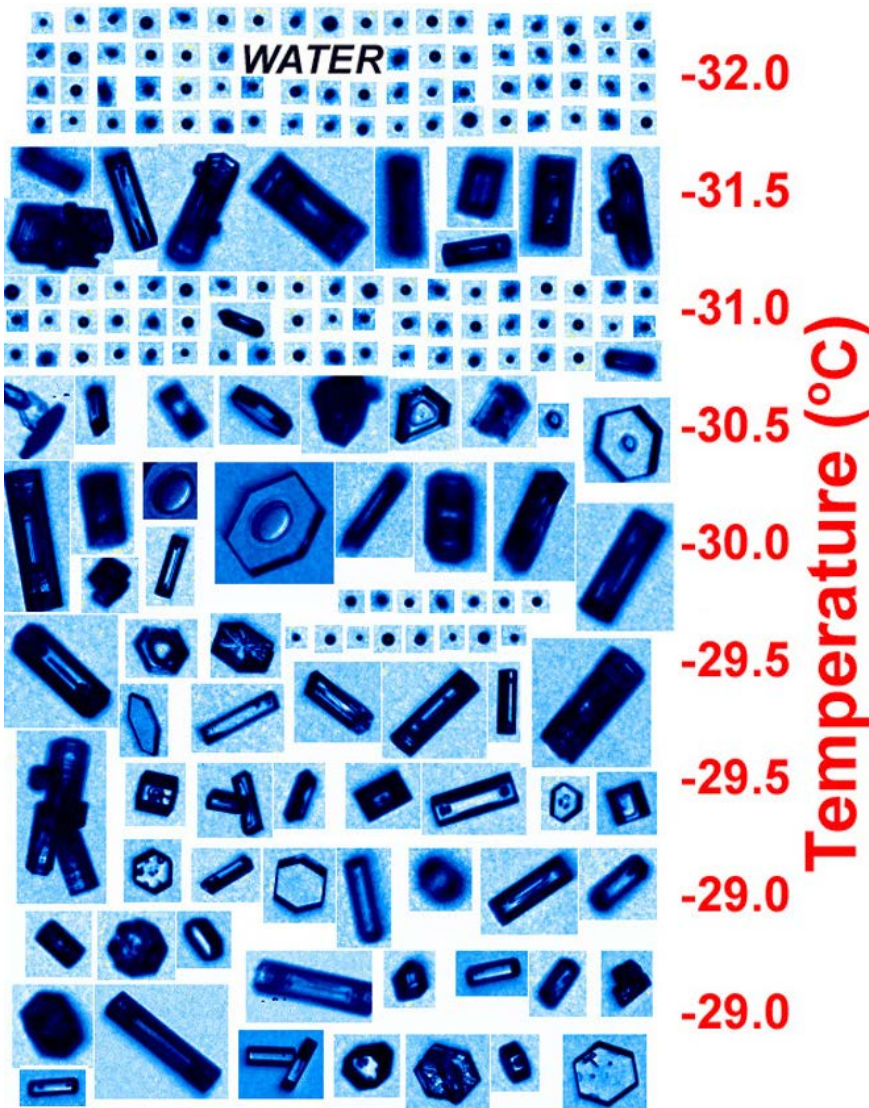
**Cloud effect on atmospheric boundary layer turbulence
Result from ACLOUD**

Seasonal Dependence ?



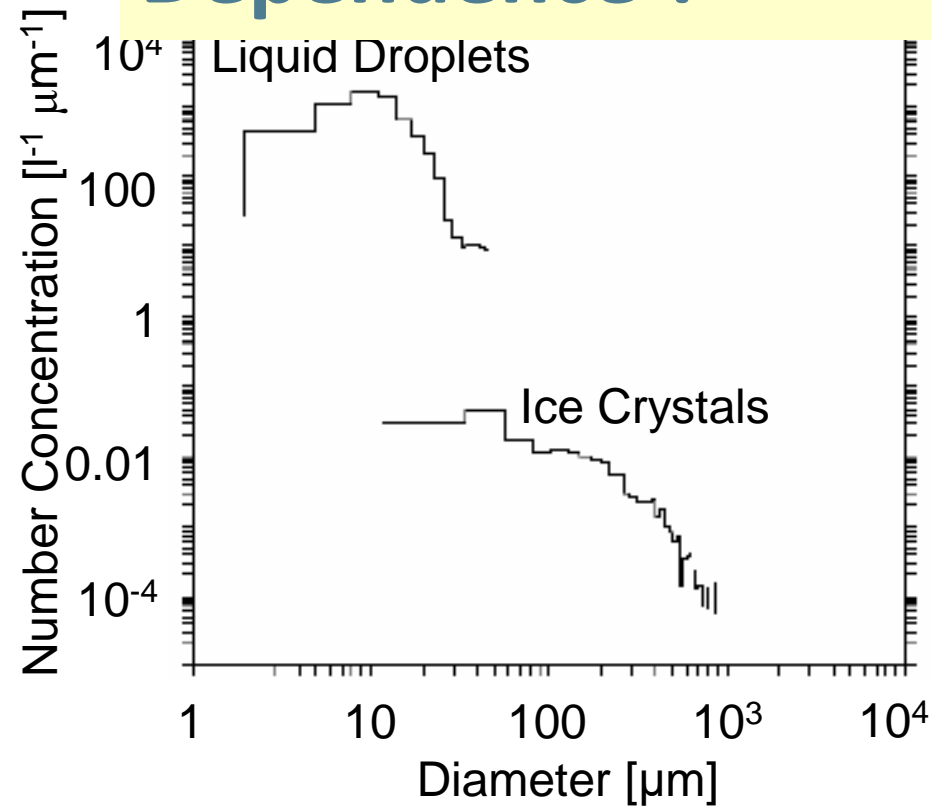
Cloudy radiative effects:

- Sea ice: $+28 \text{ Wm}^{-2}$ → WARMING
- Open Water: -170 Wm^{-2} → COOLING

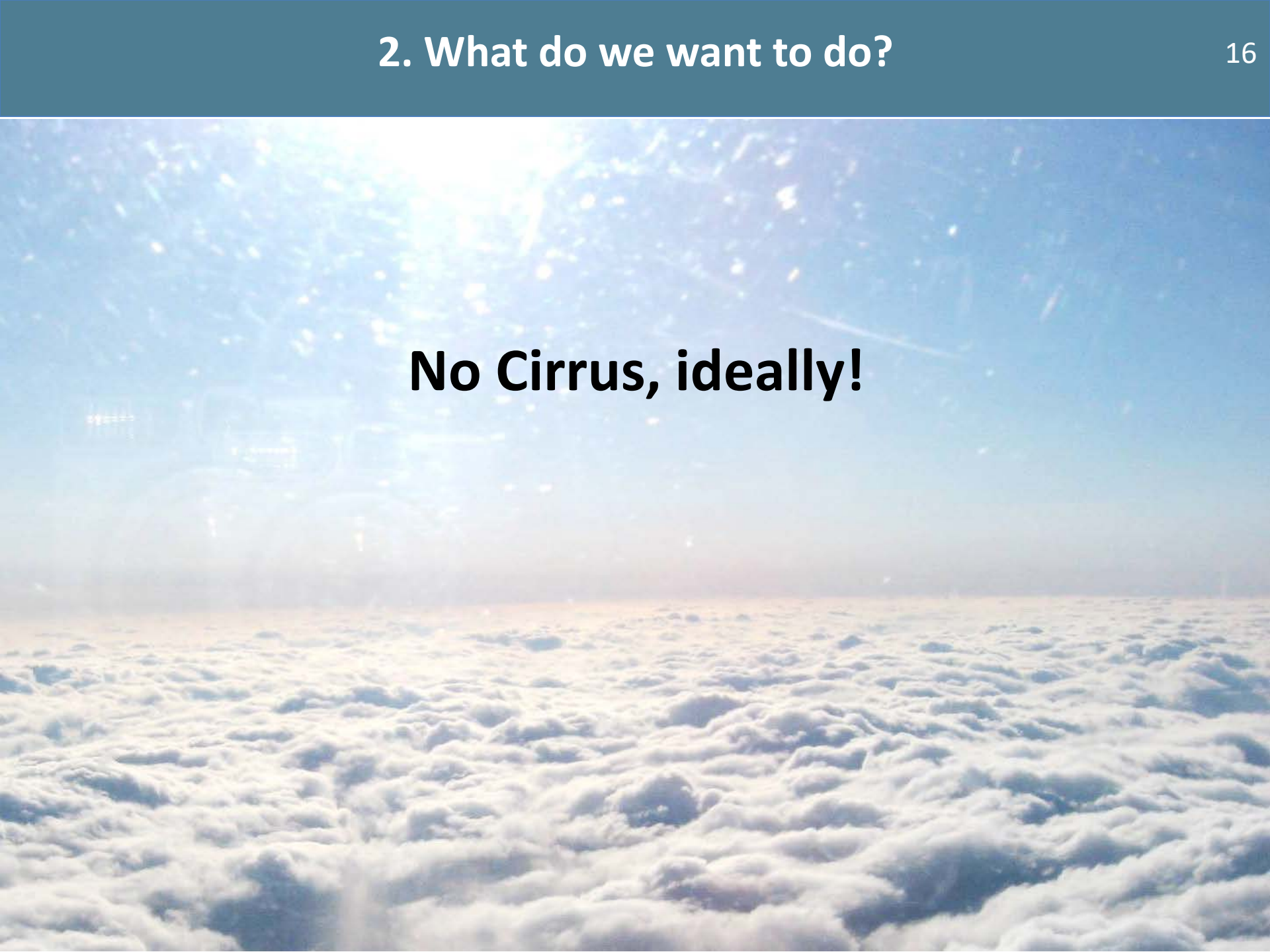


Lawson et al. (2010)

Seasonal Dependence ?



Mixed-phase clouds



No Cirrus, ideally!

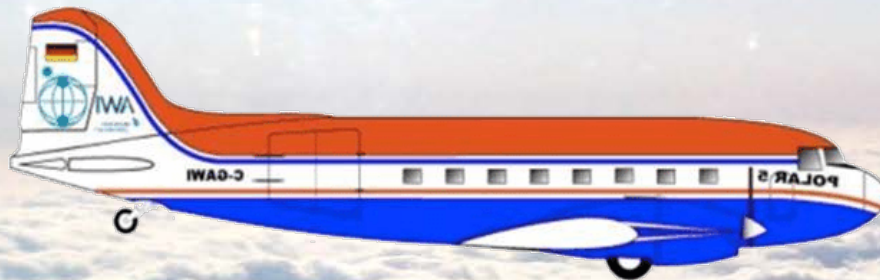
2. What do we want to do?

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Radiation + Turbulent Fluxes + Drop Sondes
+ Radar + MW Radiometer + Lidar + Microphysical Probes

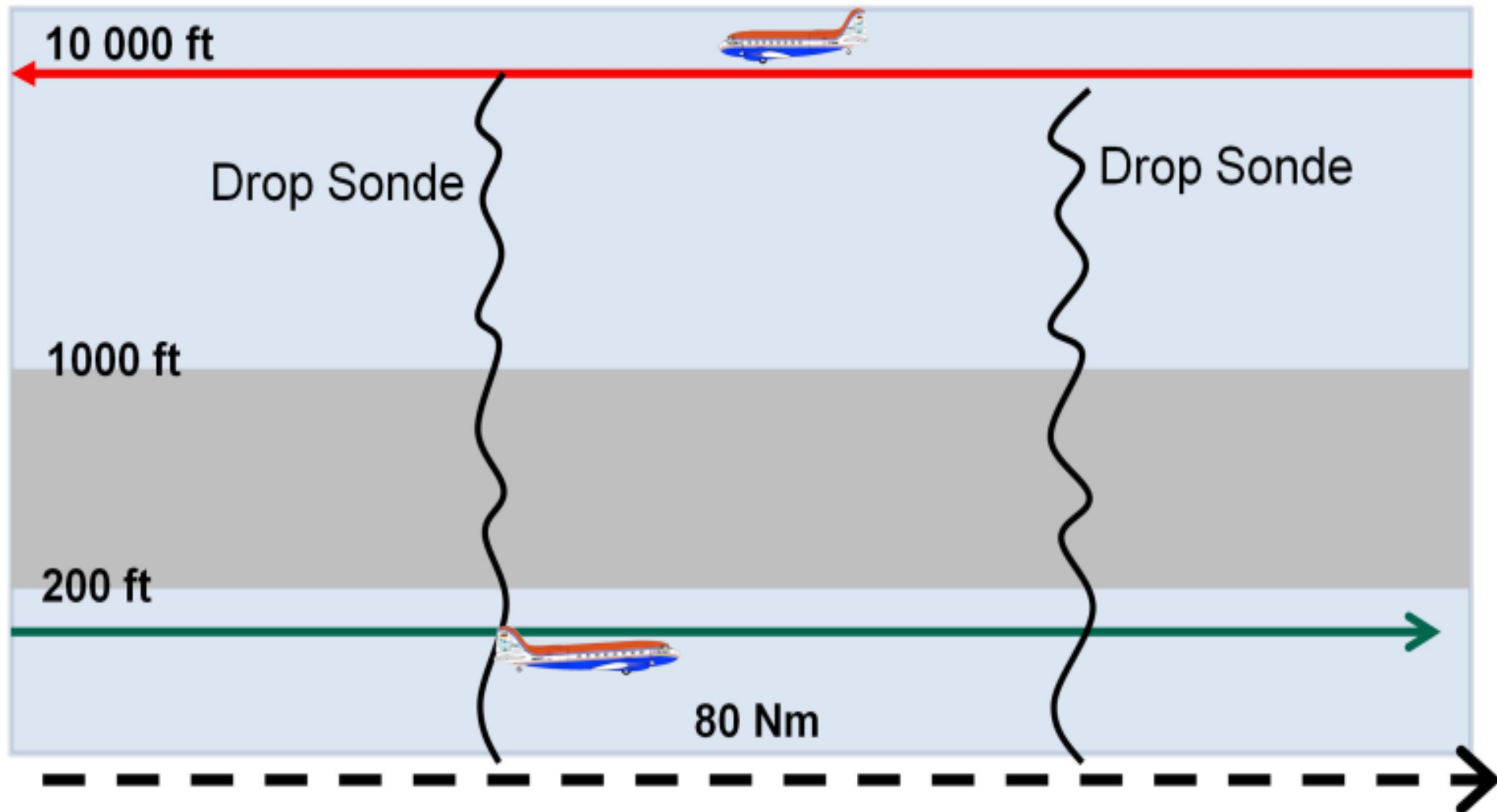
80 flight hours \approx 5 hours

We can expect during one month about 12-14 flights



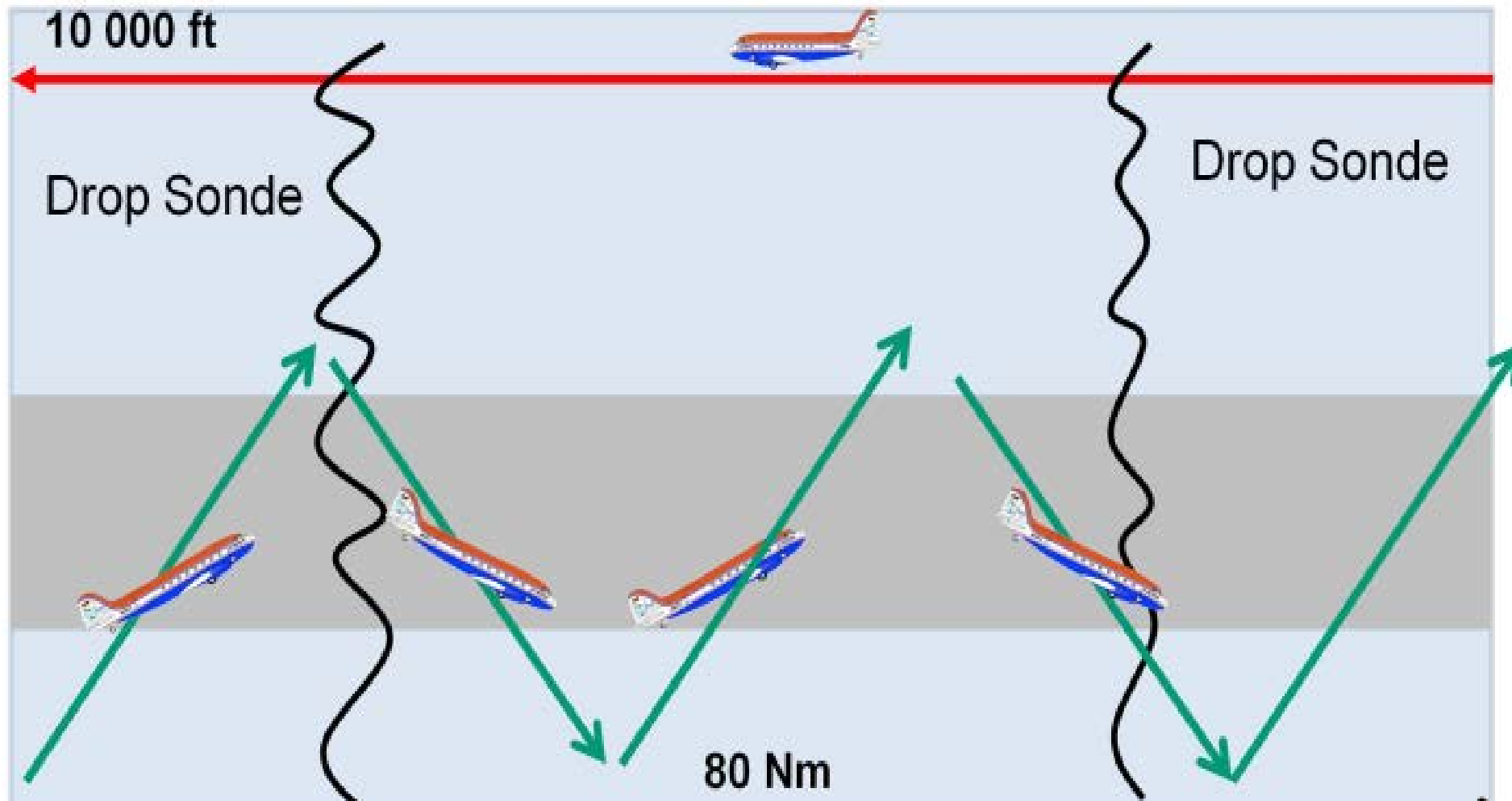
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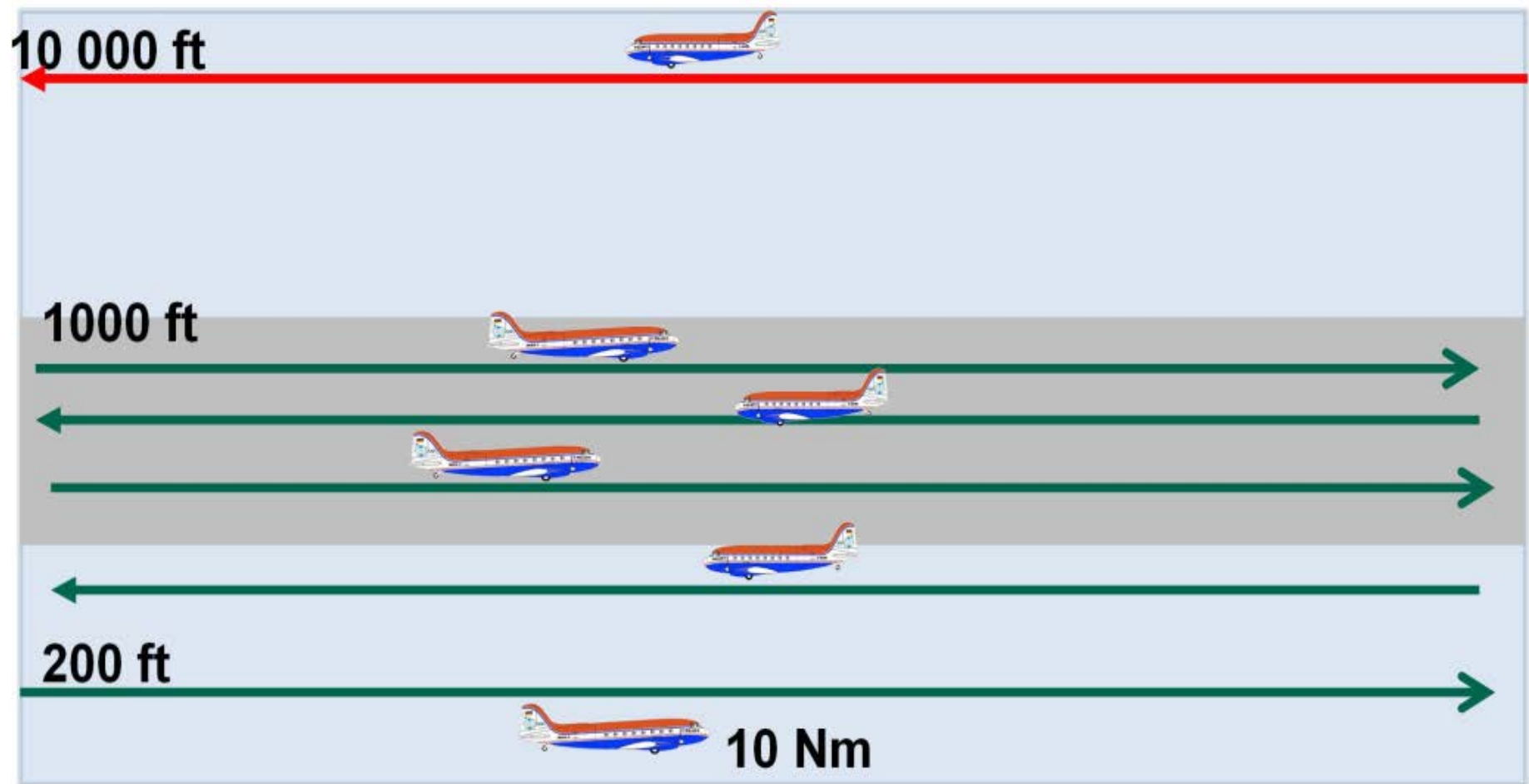
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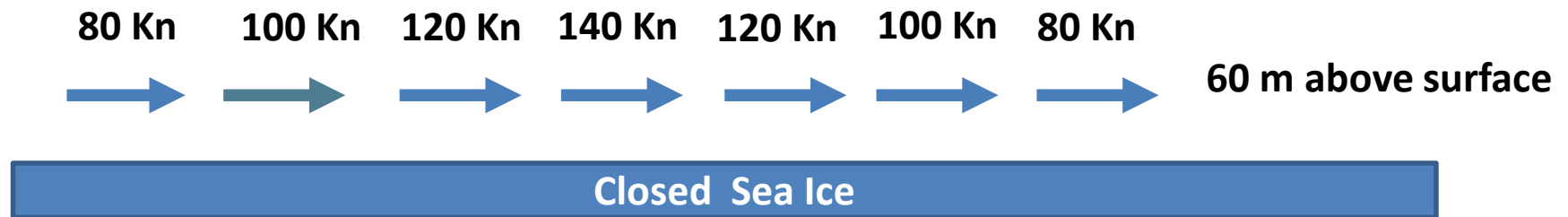
2. What do we want to do?

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To be flown only one time during the campaign:

2 min-legs with different speed (TAS) (parallel to wind)



During each flight there should be one section where the same Leg of 5 min length is flown in opposite direction.

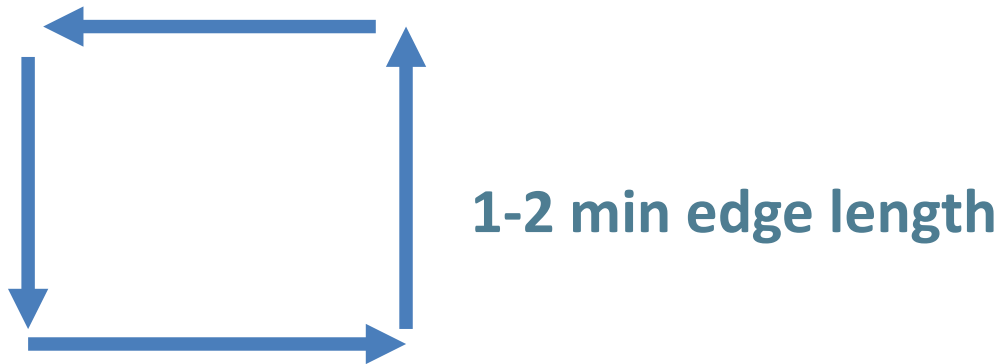
More such legs → better accuracy of our wind measurement



This can be flown below clouds, or in clouds

Also possible at high levels (e.g. 10.000 ft) on our way home

Radiation Square



First leg should be oriented towards the sun

Temp (fast): ascend from the lowest level to e.g. 3000 ft with 1000 ft/min or, vice versa, descend

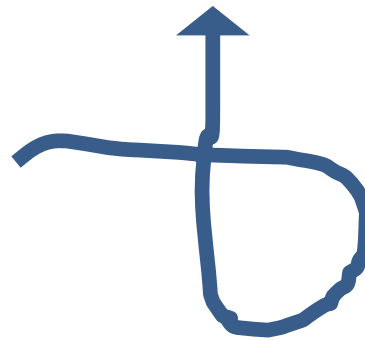
Temp (slow): ascend/descend rates of 100-200 ft/min

A temp should always reach the lowest possible height above the surface

Short turn:



Long turn:



- **Teamwork! Christof is the boss!**
- **We are flexible!**
- **Three regular meetings per day are suggested**
 - ✓ 08:00 All: Brief Met, Go/NoGo
 - ✓ 13:00 Mostly for PIs: Met, flight planning
 - ✓ 18:00 All: De-briefing, Met, Next day/flight
- **One major PI for each mission**
 - ✓ Rotating: Christof, Dmitry, Michael, Mario, André, ...
 - ✓ Responsible to manage the mission

A mission includes ...



Prep day

- 13:00 Met
- Then PI meeting (maybe not all)
- 18:00 Discussion of plans with all

Flight day

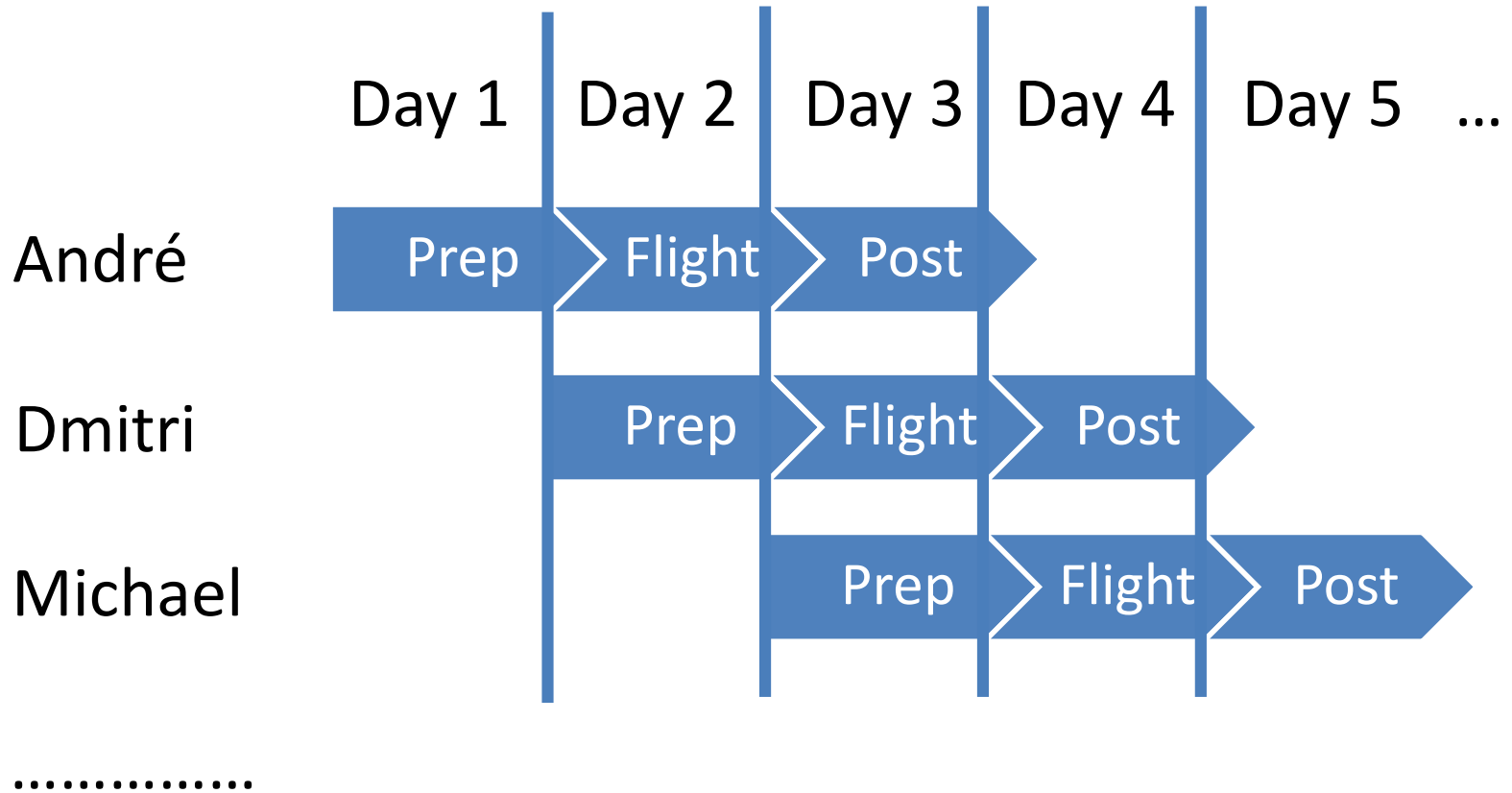
- 08:00 Met
→ Go/NoGo
- Flight
- 18:00 De-briefing meeting

Post-flight day

- Flight report

3. How do we organize ourselves?

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- **Day off**
No official meeting
- **The day after day-off**
No flight
Morning: Quicklooks/science
Afternoon: Usual prep day

**Good luck to all of us
During the AFLUX campaign**