DISCUSSION:
COMBLE modeling: approaches, challenges, and opportunities

Approaches for SCM/LES/CRM model setups, initializations, and coordinated evaluation in COMBLE, links to climate models

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COMBLE science themes:

(1) the fetch-dependent **mesoscale organization** of clouds and precipitation, **linear and cellular convection**;

(2) surface heat and momentum fluxes and vertical profiles of temperature, humidity, wind, and turbulence;

(3) vertical structure of **clouds and precipitation**;

(4) the sources and sinks of aerosol, including ice nucleating particles, and the role of cloud-active aerosol on cloud processes and radiative fluxes;

(5) the influence of the above four themes on polar cyclogenesis and polar low vertical structure.

6th overarching theme: *to provide integrated data sets … that will enable **constraining high-resolution numerical simulations**, developing process-level understanding, and, subsequently, **evaluating and improving representations** of shallow convection **in weather and climate models**.*

Bear Island

flow
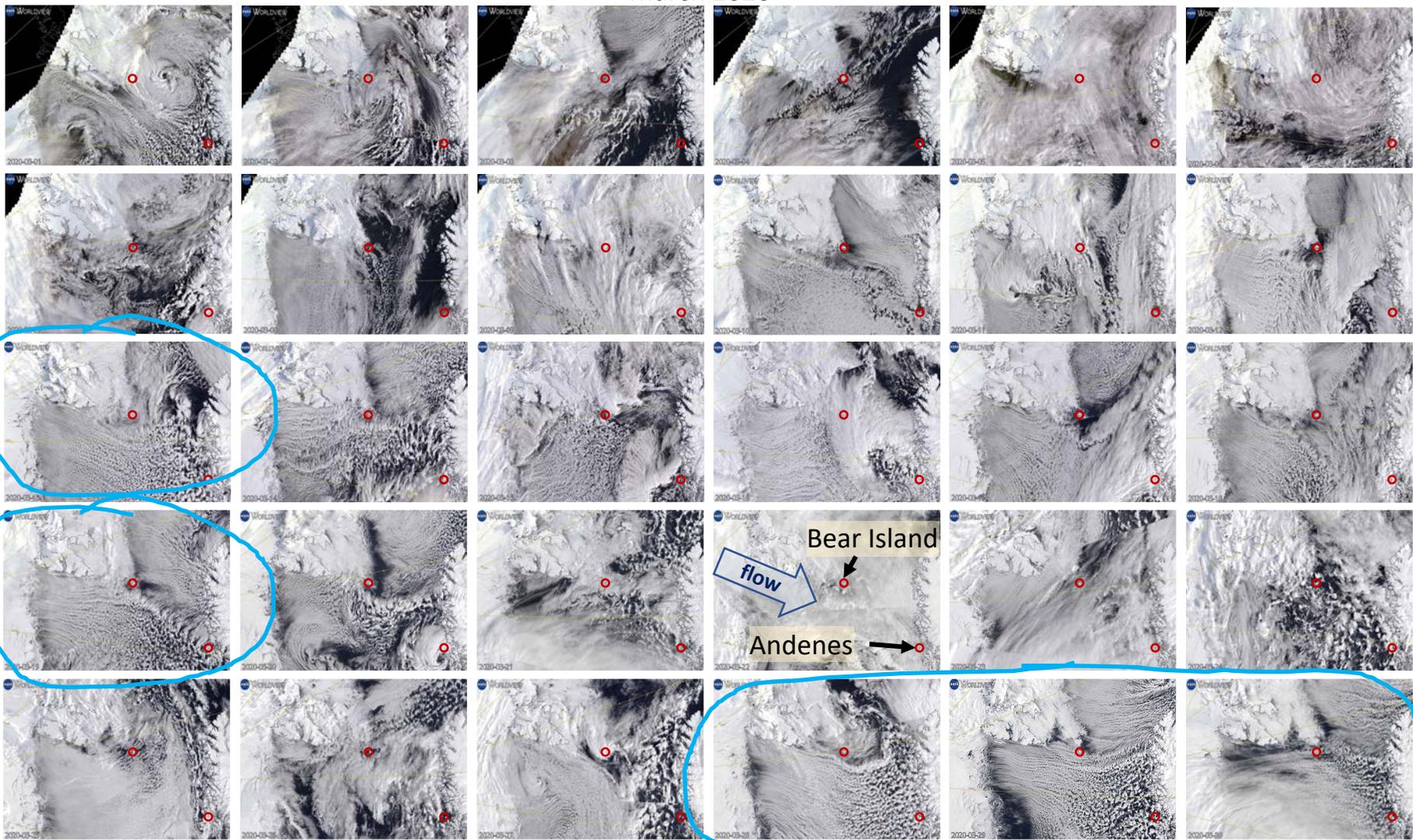
Andenes

Potential CAO case studies:

March 13, 19, and 28-30

March 29, Bear Island is on the edge of CAO cloud field,

provel possibly relevant soundings midway between

Svalbard and Andenes.

anxkazrcfrgeM1.a1 reflectivity on 20200329

ANX KAZR
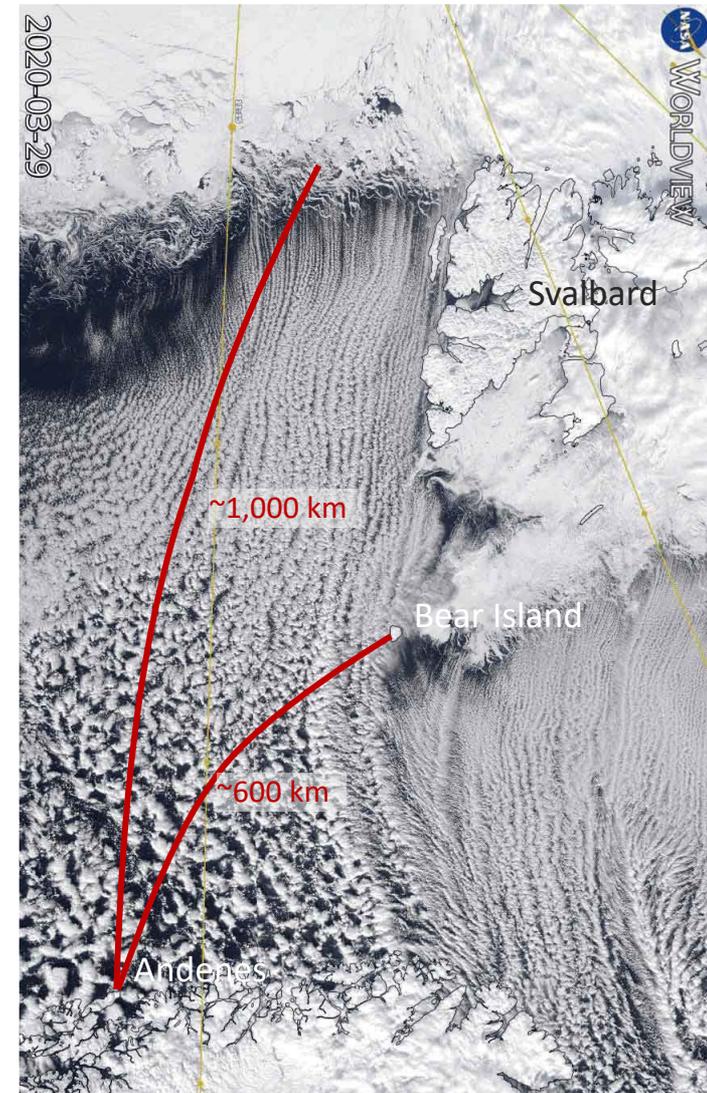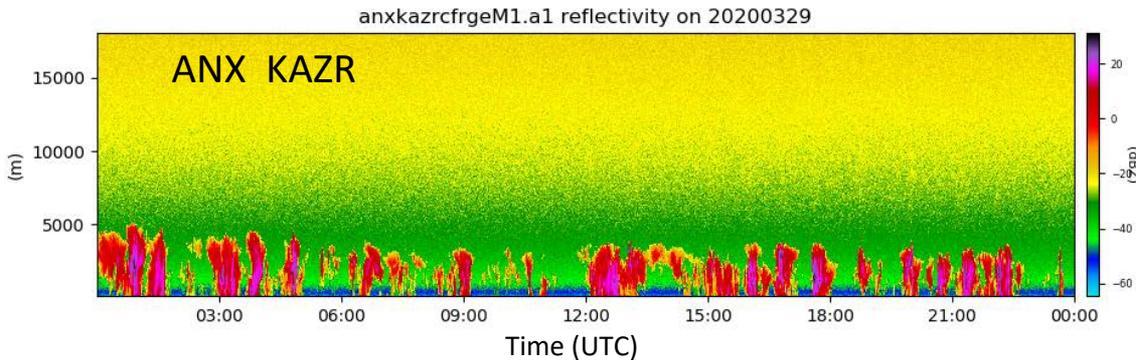
Approaches for LES/CRM and SCM modeling

Modeling a steady state vs evolution

Case study vs long-term statistics

Simulation setup:

- domain & resolution: fixed or moving domain, nesting;

- initial conditions;

- boundary conditions and forcings: surface properties/fluxes over

a site or trajectory; define an appropriate domain.

Field et al., 2017

Potential challenges:

Complex synoptic and mesoscale environment (including coastal effects)

Lack of in situ data for process studies

Low sun angles, lack of visible satellite imagery (Dec-Feb)

Two sites often are in different environments (Bear island in often in Svalbard's shadow)
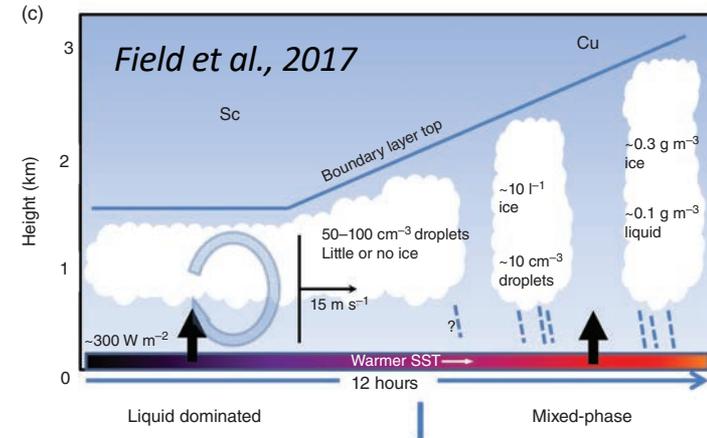
What, who, and how

New to CAO:

    think about opportunities, relevance to your science, applicability of your tools

Working on CAO:

    advertise your project, share your experience, propose a case/question

Collaboration (model intercomparison) takes efforts, why get involve:
    You don't' have to; there are single PI questions;
    Benefit/effort ratio increases after critical number of participants is reached;
    Learn about and improve your model (you'll be surprised what you find in there);
    Get more robust answers to science questions;
    Leadership opportunity for junior scientist.

Be proactive, get in touch, and COMBLE team will assist

Look for and respond to follow-up communication

Desired observations

Boundary layer structure / profiles (wind, temperature, moisture)

Sea surface temperature

Cloud macro properties:

- cloud fraction, base and top heights

- liquid and ice water paths

- precipitation rate (surface & elevated)

Cloud microphysics:

- liquid/ice phase partitioning;

- droplet and ice particle size distributions

Aerosol:

- CCN and INP concentrations, size distributions, composition, etc.