Improving short-term forecasts of the Arctic ocean-sea ice-atmosphere coupled system using wintertime statistics from the MOSAiC campaign

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MOSAiC The International Arctic Drift Expedition

NOAA

CIRES

METEO FRANCE Toujours un temps d'avance

ECMWF

U.S. NAVAL RESEARCH LABORATORY

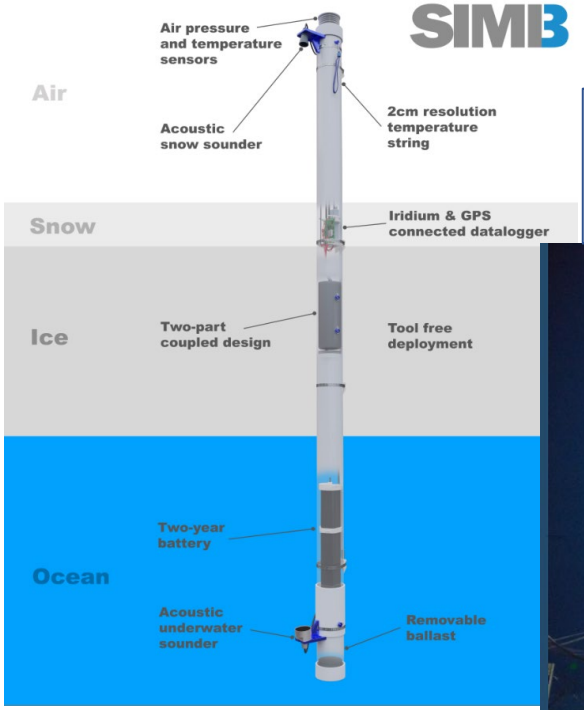
DWD

Stockholm University

Meteorologisk institutt

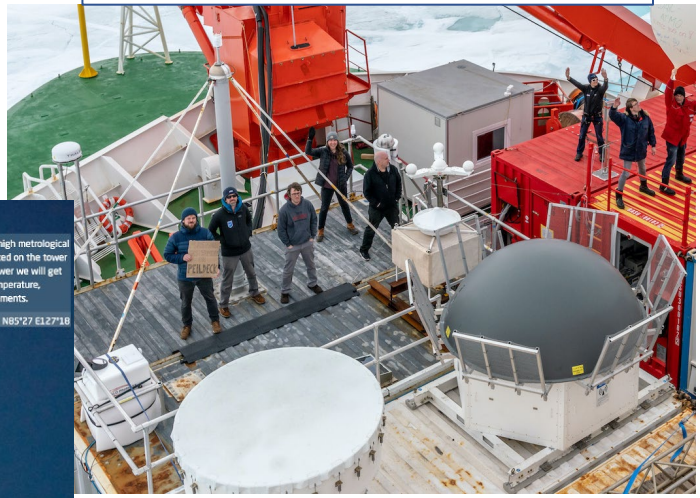
Wintertime Measurements at L-Sites and Polarstern

Sea ice and snow measurements at L-sites
(Don Perovich and colleagues)



30-meter Tower and 3-meter Flux stations at L-sites and Met City
(Matt Shupe and colleagues)

Radar, Lidar, Aerosol particle counters, etc on Polarstern
(DOE ARM scientists)



Goals of MOSAiC Forecast Verification Studies

(Coordinated with YOPP Processes and Sea Ice Task Teams)

Use observations taken during MOSAiC to improve the simulation of wintertime coupled processes unique to the Arctic, such as;

- The persistence and maintenance of mixed-phase clouds
- The representation of the stable boundary layer
- Atmosphere-snow interaction
- Ocean-sea ice-atmosphere coupling

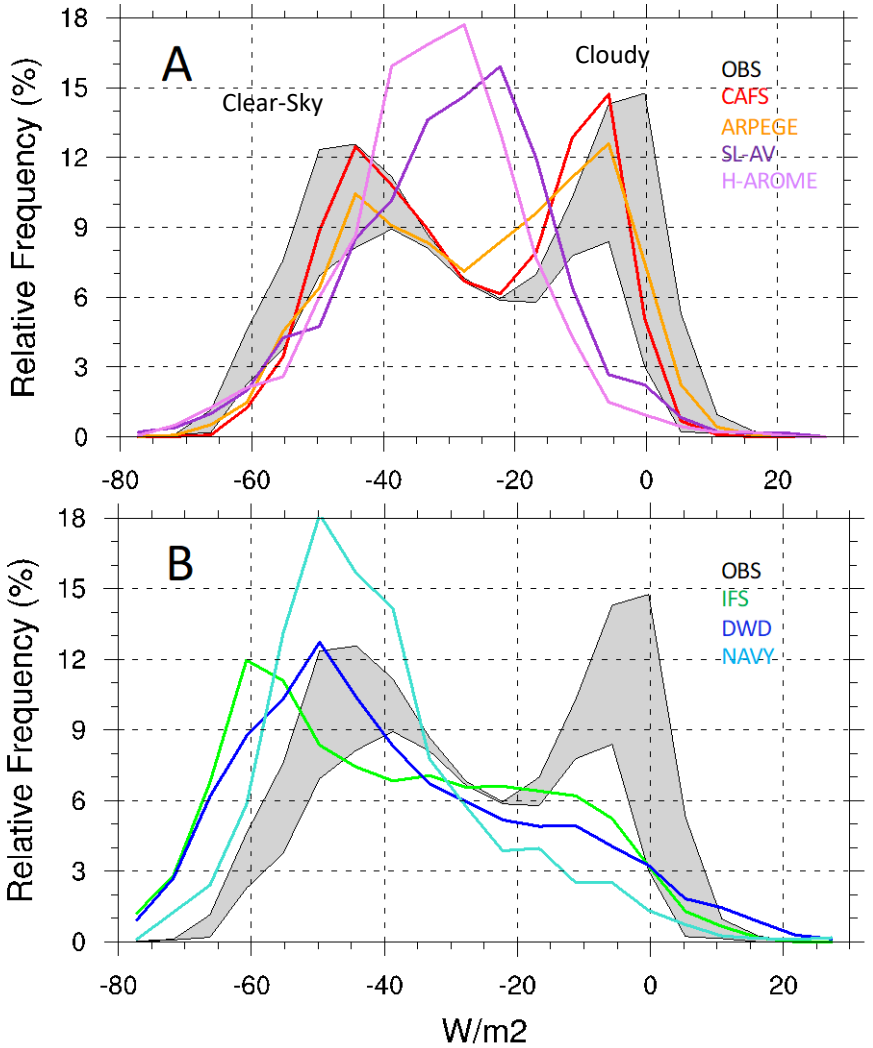
Short-term forecasts and wintertime statistics are used in this project to identify potential errors in the representation of "fast" processes that cause biases in climate model projections of Arctic climate change

→ Five fully coupled atmosphere – ocean – sea ice forecast systems

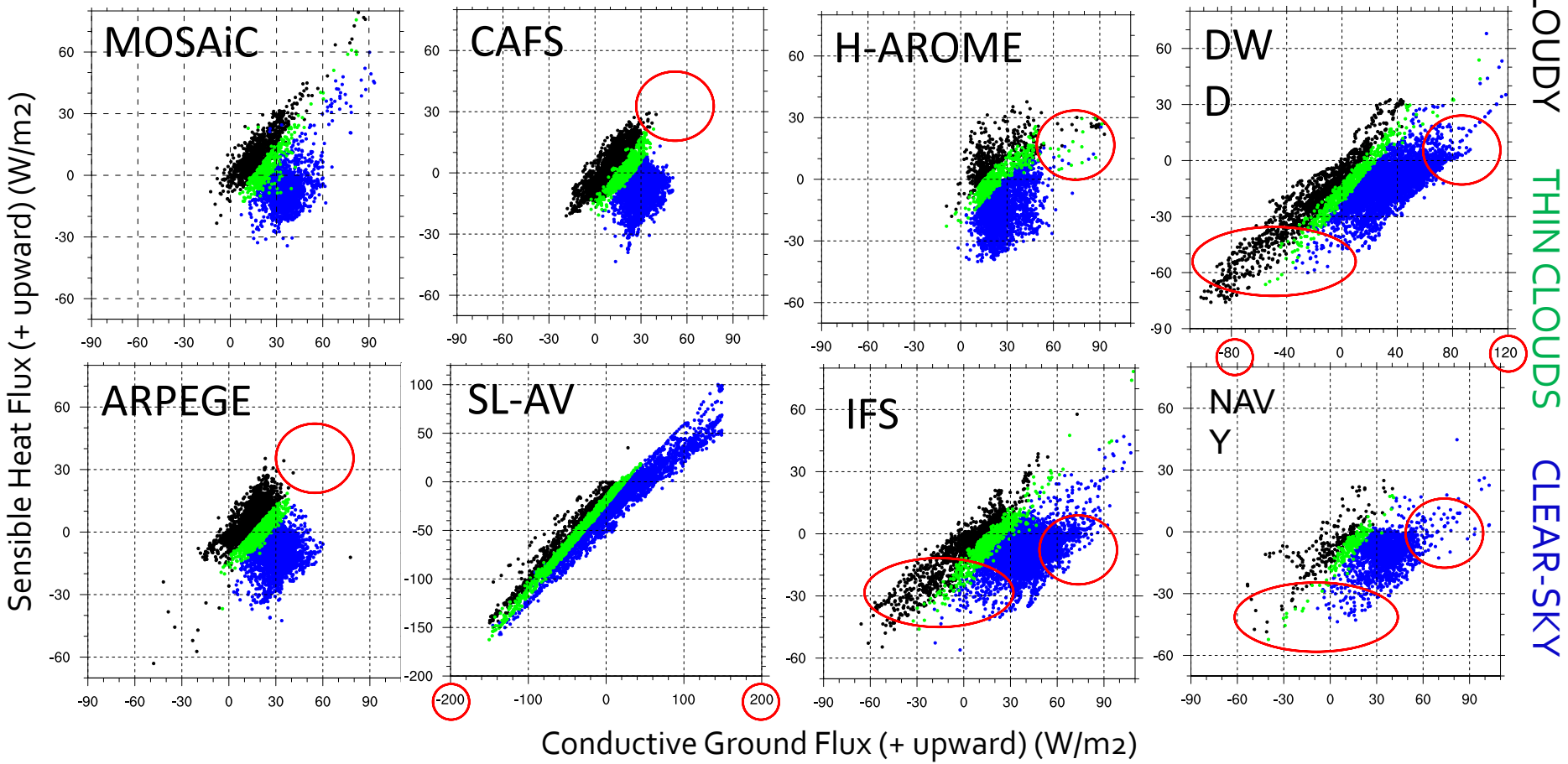
PDFs of Net Surface Longwave Fluxes

Only 2 models simulate observed distinct bi-modal clear-sky & cloudy modes

3 models have distinct clear-sky modes but underestimate the cloudy mode



Cloud-Turbulence-Ground Flux Interactions



Goals of MOSAiC Near Real-Time Verification

Phase 2: Focus on forecasting of case studies

MOSAiC Forecasting Coordination Table:

Forecasting for Event Planning: Is your team interested in real-time forecasting (operational or experimental) for:	AWI-P	AWI-B	DWD	NOAA/CU	SIO/SOA	NRL (global)	NRL (meso)	NERSC	CU-UAV	NASA GMAO	ECCC Global ensemble (daily 16d, weekly 32d)	ECCC Global (10d)	ECCC regional (2d)	SU/ECMWF
Precipitation events			Yes	Yes					No	Yes - exp.	Yes	Yes	Yes	Yes
Storms/cyclones			Yes	Yes		Maybe			No	Yes - exp.	Yes	Yes	Yes	Yes
Lead formation			Yes	Yes				yes	No		Yes	Yes	Yes	
High-wind events			Yes	Yes					No	Yes - exp.	Yes	Yes	Yes	Yes
Moist/warm air intrusions			Yes	Yes		Maybe			No	Yes - exp.	Yes	Yes	Yes	Yes

Forecasting for Science Operations: Is your team interested in providing real-time forecasts (operational or experimental) for:														
Conditions at ice camps (break-up/high-wind/fog)			high-wind/fog	Yes			Yes	yes			Yes	Yes	Yes	Yes
Helicopter operations (visibility/ceiling height)				Yes							Yes	Yes	Yes	Yes
TBS/UAV operations (CL liquid/high-wind/visibility)			CL liquid/high-wind	Yes					Interested in the output		Yes	Yes	Yes	Yes

Is your team interested in real-time forecast verification?			
Atmospheric conditions: Validation with radiosondes, surface fluxes			Yes
Sea ice conditions: Validation with drift, lead formation			
Precipitation events			yes
Ocean mixed layer depth/TS/currents			
Atmospheric Conditions: Validation with UAS and other obs			

Will your team be archiving forecast model (operational or experimental) output?			
2D Atmosphere (following YOPP protocol)			15 months
Vertical profiles at YOPP sites (YOPPsiteMIP)			
2D Sea ice properties			
2D Ocean properties			
BGC/Eco			

DWD archives data on the native grid for 15 months, regular grid for

Is your team interested in events evaluation?

- Precipitation events (11 centers)
- Storms/cyclones (11 centers)
- Lead formation (8 centers)
- High-wind events (14 centers)
- Moist/warm air intrusions/atmospheric rivers (10 centers)

Thank you to all the MOSAiC participants that made these studies possible