THE UNIVERSITY OF MELBOURNE

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MARGINAL ICE ZONE HEAT FLUXES FROM HIGH-RESOLUTION THERMAL IMAGING OF ANTARCTIC SEA ICE SURFACE TEMPERATURE

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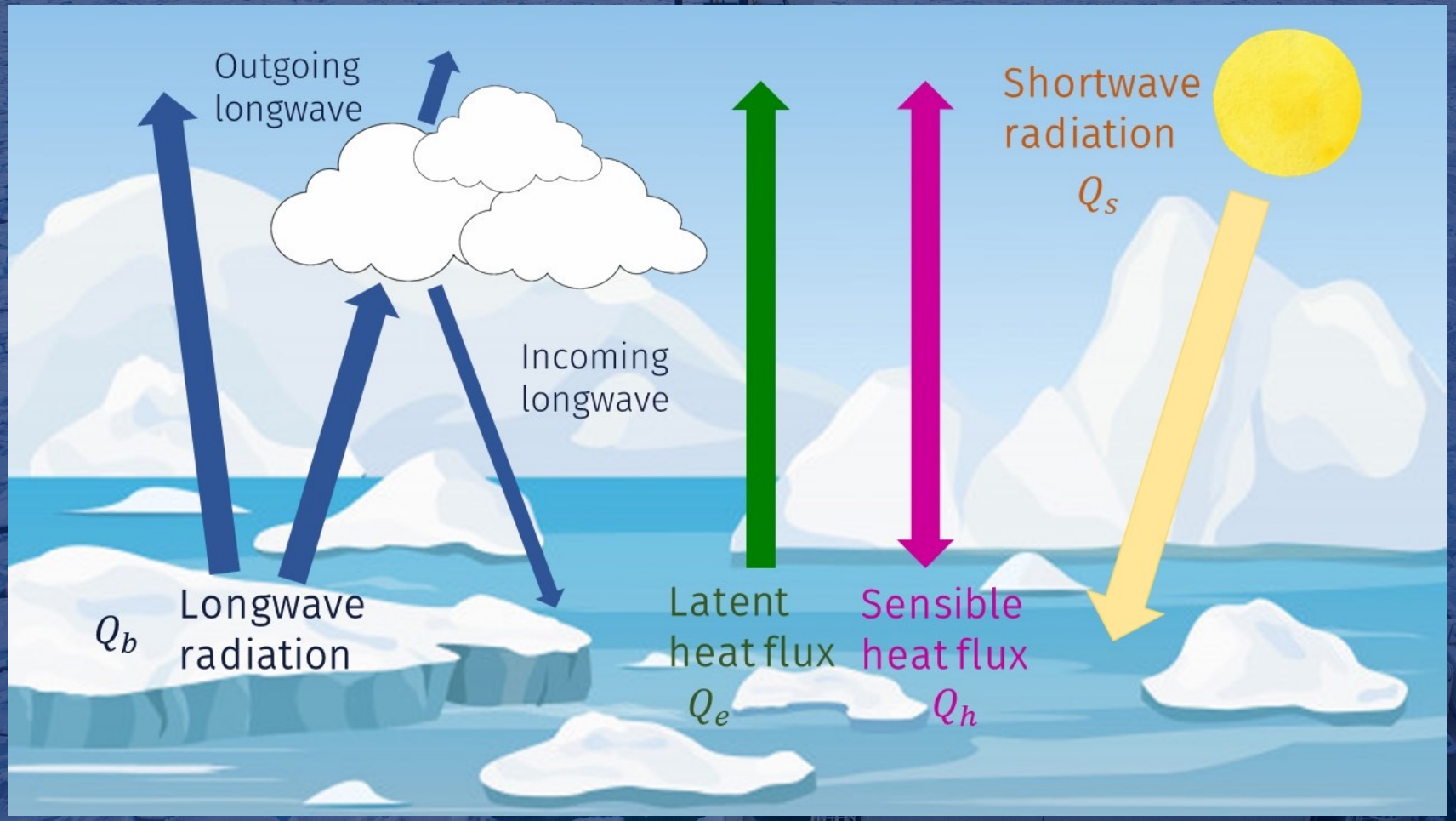
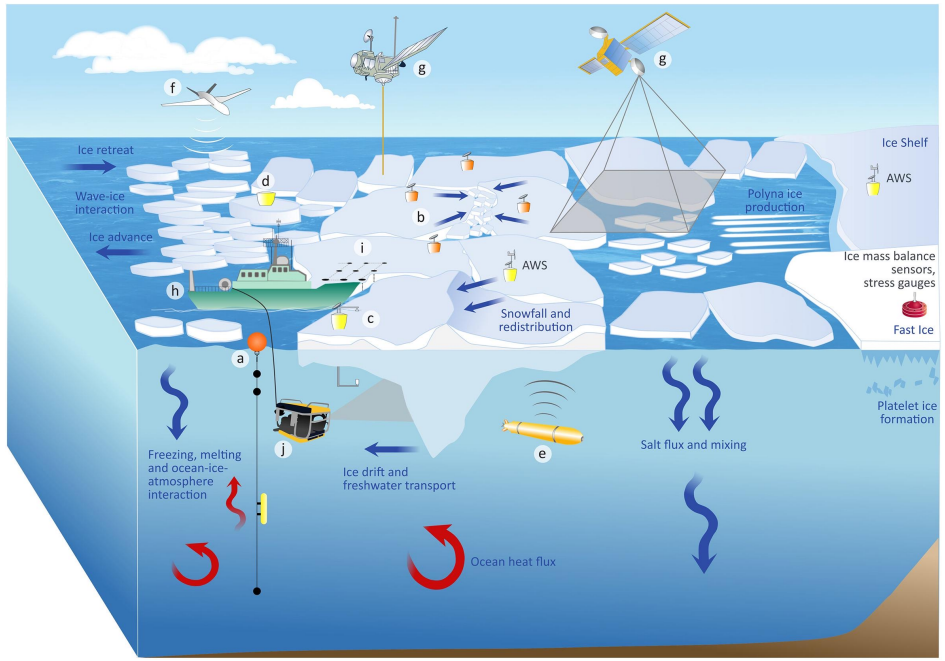
INTRODUCTION

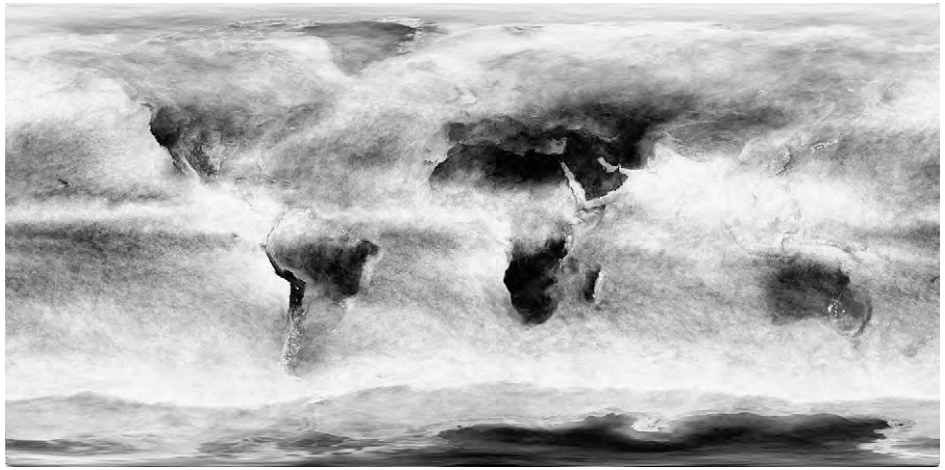
Surface energy budget $Q_T = Q_s + Q_b + Q_e + Q_h$ $[W/m^2]$



Surface heat fluxes scheme



Meredith et al. (2013).



NASA Earth Observatory (2010).

Limitations

- The type and thickness of ice is hard to estimate from satellite observations

(e.g., Talley, 2011)

- Limited satellite resolution
- The accuracy of IR-derived S-IST products is affected by clouds and darkness

(e.g., Li, 2019: Comiso, et al, 2016)

What is missing?

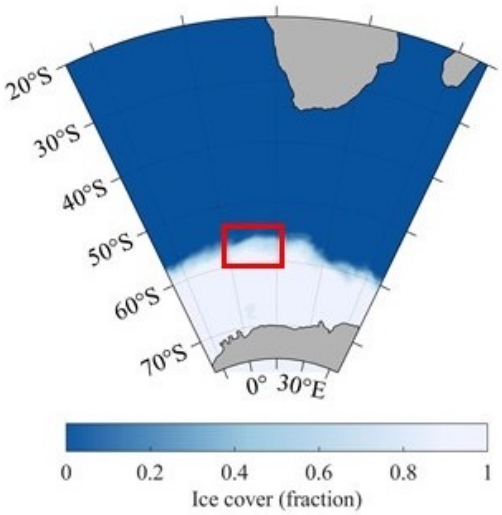
Reliable Southern Ocean in-situ observations

Research objective

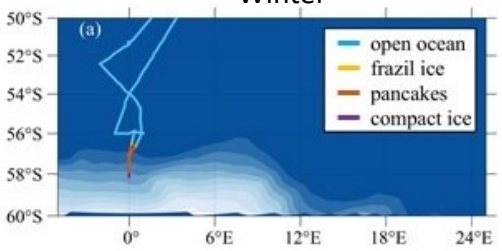
- Applying IR sensors to measure sea ice thermal footprint in the MIZ (short-term)
- Validate satellite observations and sea ice model performance with field data (long-term)

FIELD OBSERVATIONS

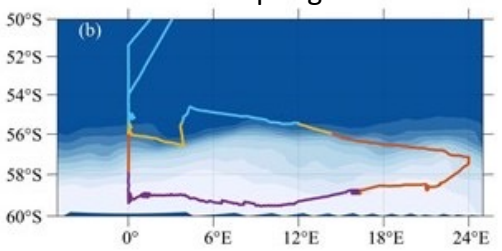
SCALE
Southern oCean seAsonaL Experiment



Winter



Spring



S-IST measurement team

Telops IR-camera

Frazil ice/nilas

Pancakes

Compact ice

Measurements:

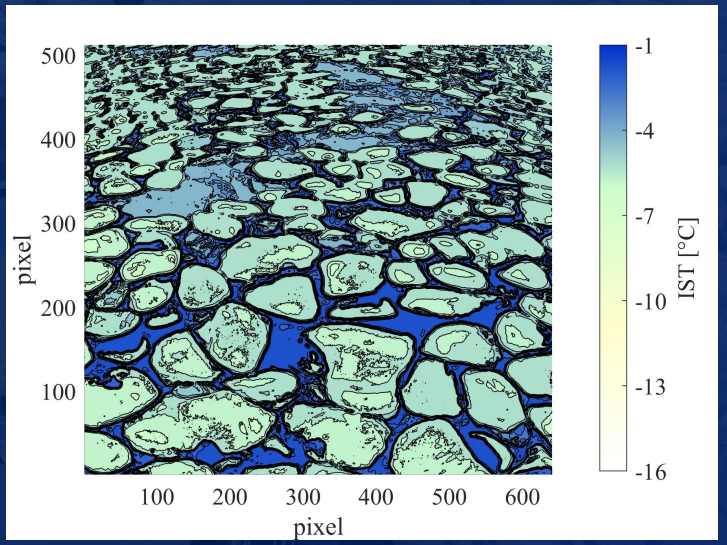
Southern Ocean marginal ice zone (MIZ). 2019 Winter-Spring campaigns

Instrument:

Thermal Infrared (IR) camera

Data:

Sea-Ice surface temperature (**S-IST**)

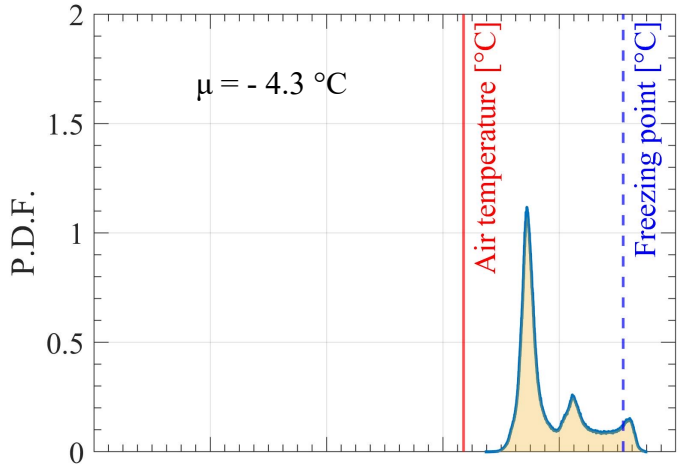


IR image of sea ice surface

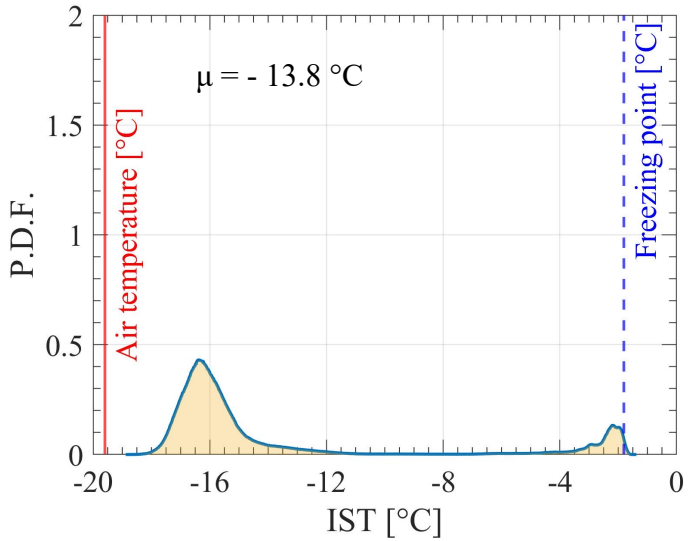
RESULTS

IST FROM THERMAL CAMERA

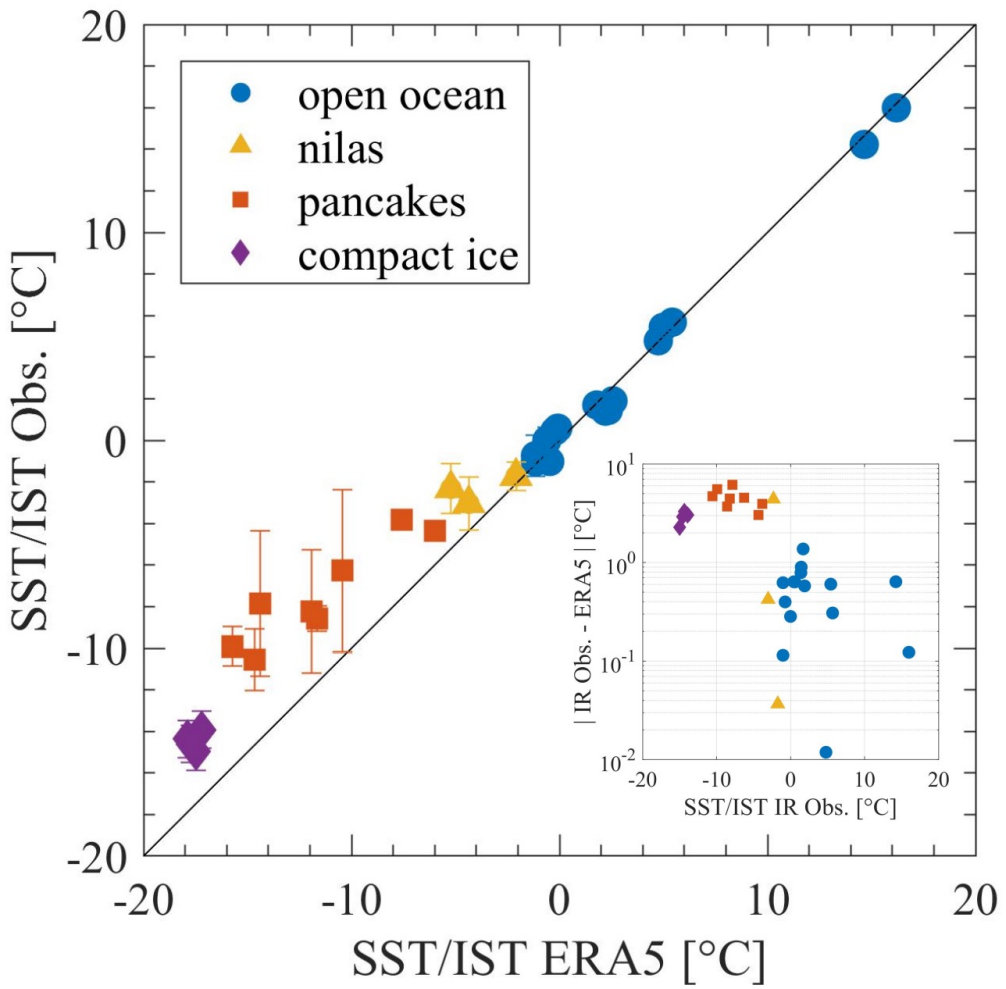
IST P.D.F. distribution in **PANCAKES** condition



IST P.D.F. distribution in **COMPACT ICE** condition



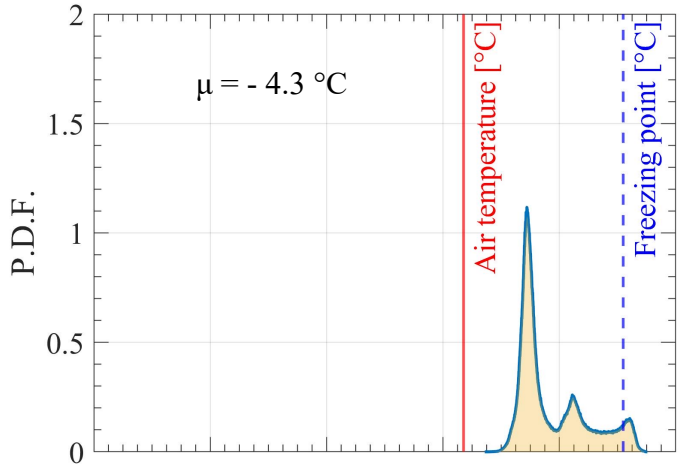
COMPARISON OBS. VS ERA5 MODEL



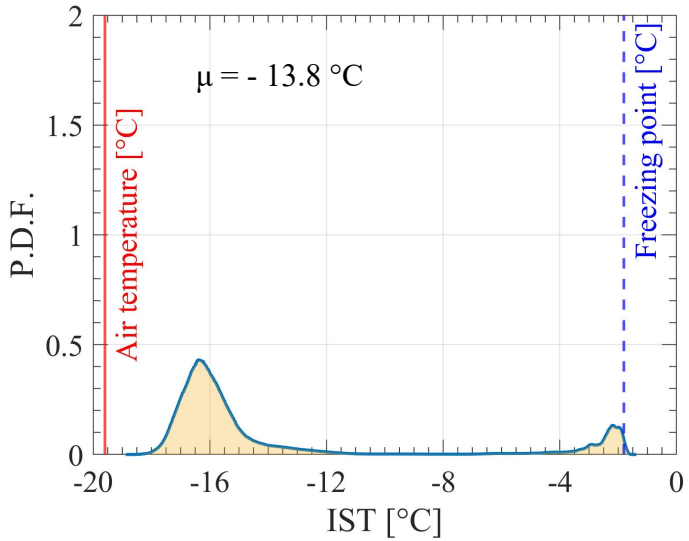
RESULTS

IST FROM THERMAL CAMERA

IST P.D.F. distribution in **PANCAKES** condition

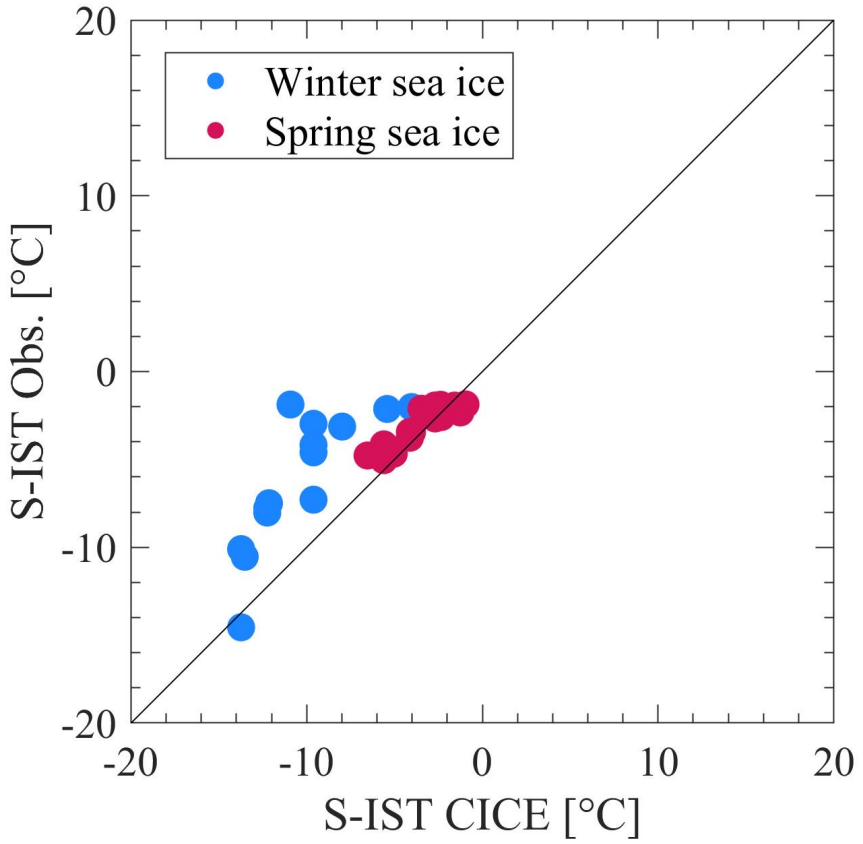


IST P.D.F. distribution in **COMPACT ICE** condition



COMPARISON OBS. VS CICE MODEL

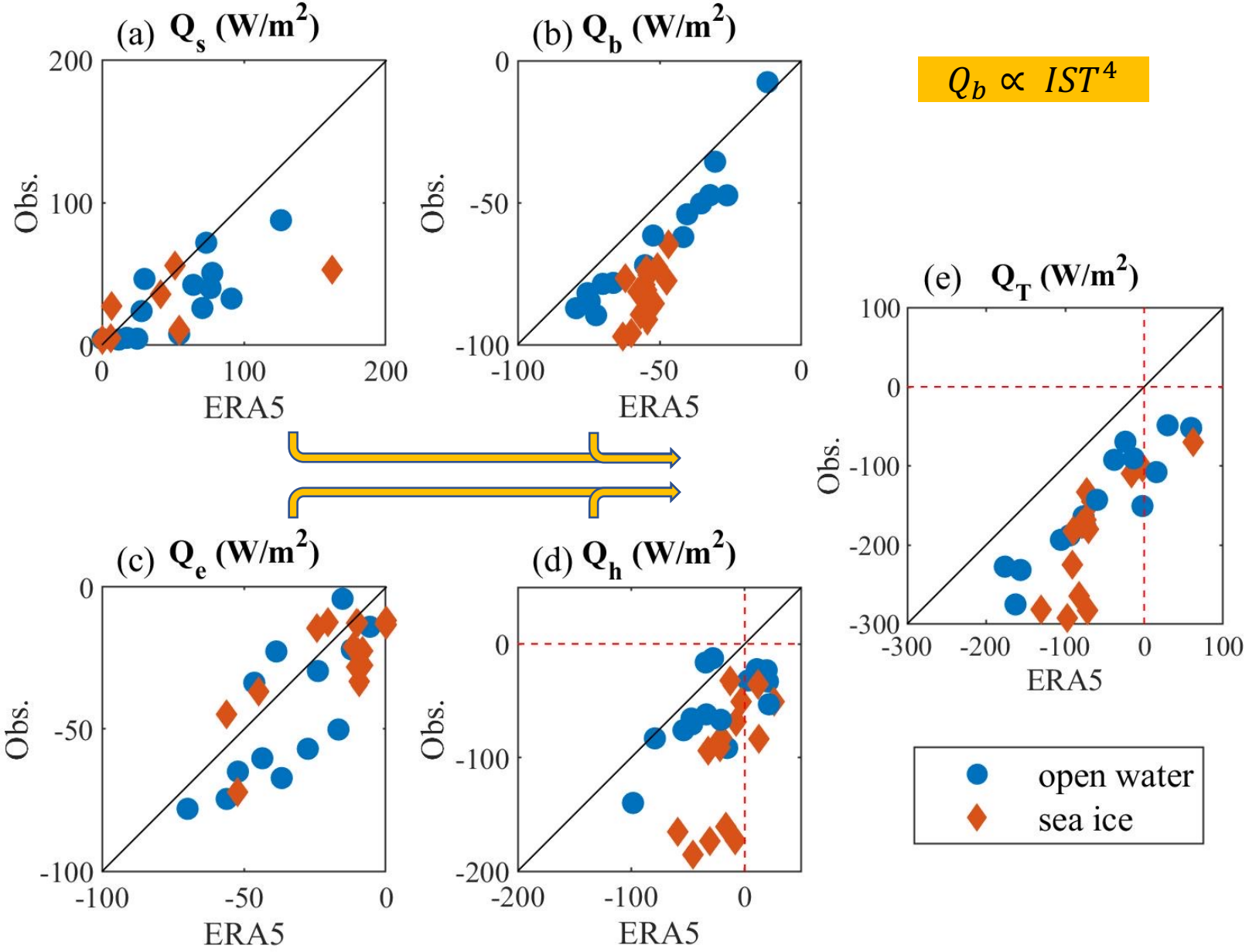
PRELIMINARY RESULTS



Default model conditions with 0.5-degree grid

Data provided by Noah Shepherd Day, The University of Adelaide

SURFACE ENERGY FLUXES AND TOTAL HEAT BUDGET



$$Q_b \propto IST^4$$

CONCLUSIONS

Novel measurements of the S-IST in the MIZ with the IR camera

The S-IST is non-uniform in the MIZ

Uncertainties of the S-IST measurements at high latitude cause discrepancies in the model estimates

Inaccuracy of the S-IST variable affects the quantification of thermal radiation (Q_b) loss from the ocean