CONSTRUCTION OF A GAP-FREE MULTISENSOR ICE SURFACE TEMPERATURE PRODUCT FOR THE GREENLAND ICE CAP AND ASSIMILATION INTO ATMOSPHERE AND ICE SHEET MODELS (UCS #2)

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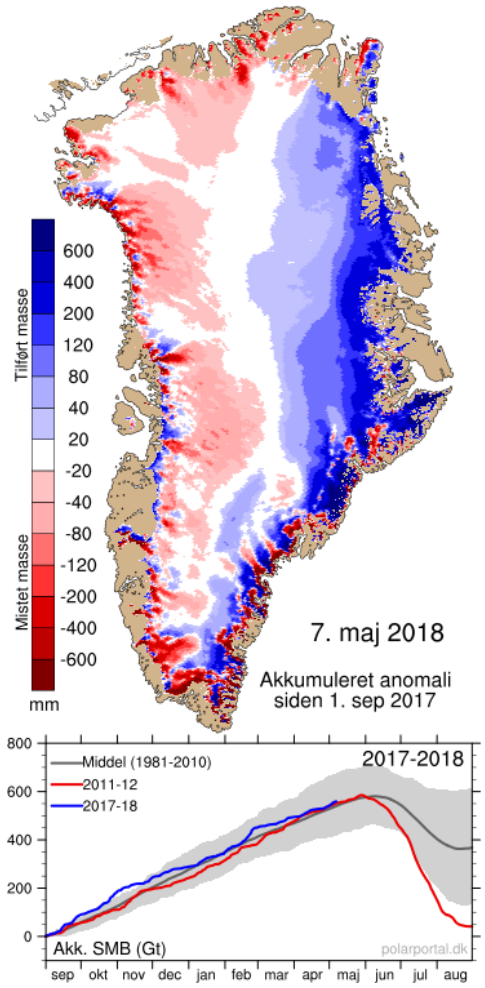
OBJECTIVE

"Use LST data to construct a multi-sensor L4 product and evaluate the performance of the regional climate model (RCM) HIRHAM5 in calculating the surface energy budget over the Greenland ice sheet and in determining the extent of surface melt"



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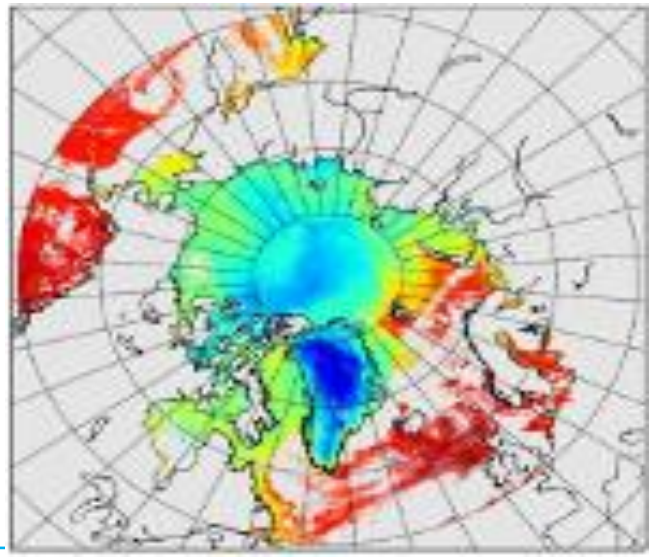
TASKS

- **Validation of level 2/3 IST products**
- **Preparation of level 4 IST data set**
- **Evaluation of HIRHAM5 regional climate model surface temperature.**
- **Snowpack model simulations**
- **Reporting and article writing**



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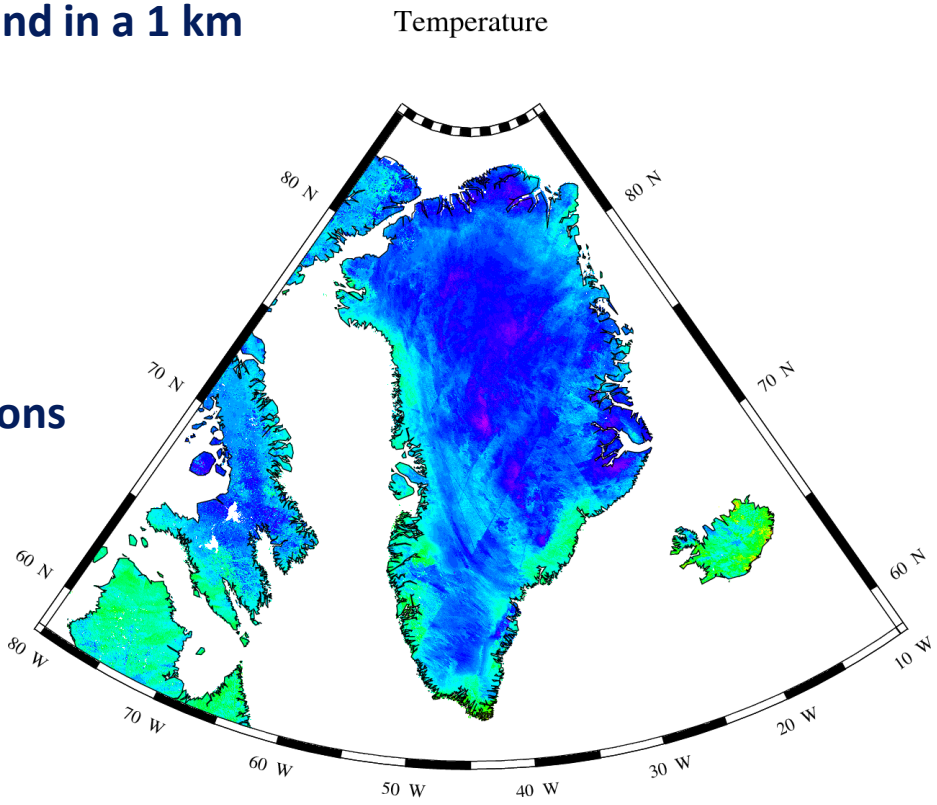
PROGRESS

- **L2 orbit data downloaded from CEMS for year 2012**
  - AATSR
  - MODIS
  - AVHRR GAC, AASTI (DMI)
- **L4 processing chain set up for Greenland in a 1 km resolution**
- **Test runs conducted**
  - L2 -> L3 (L3S)
  - L3 -> L4
- **Validation against IceBridge observations**
- **Full year 2012 L4 data set completed.**



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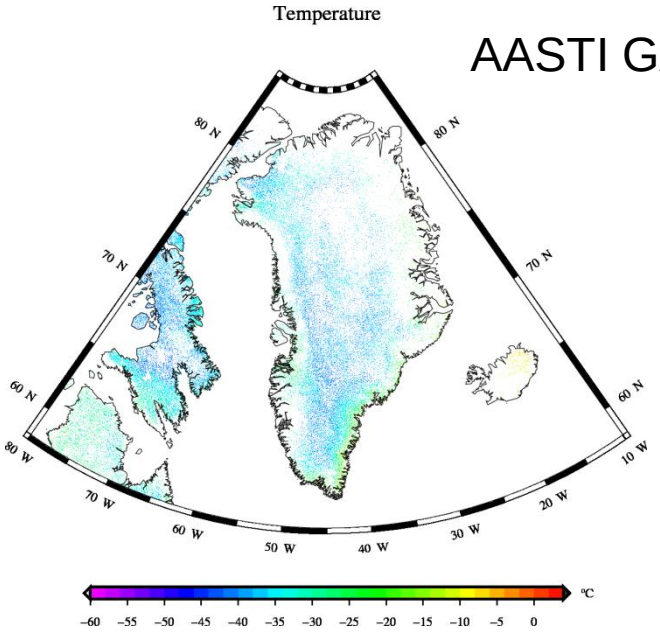
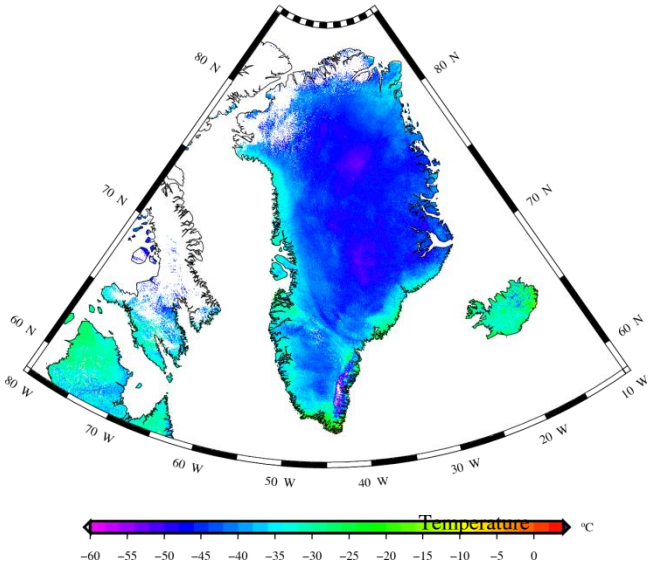
L2 -> L3 -> L4 SATELLITE IST

2012010912

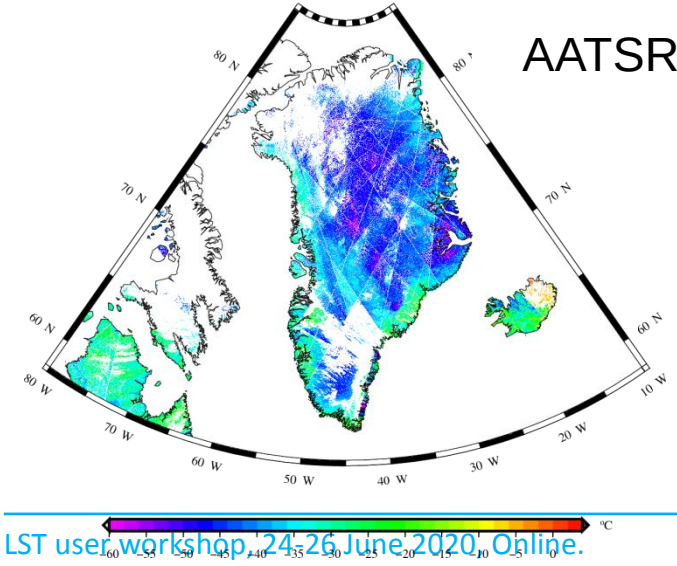
AASTI GAC



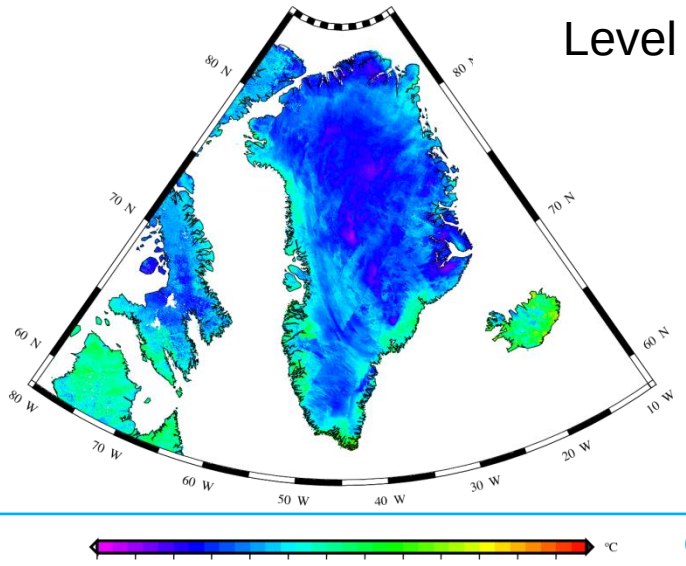
MODIS



AATSR



Level 4



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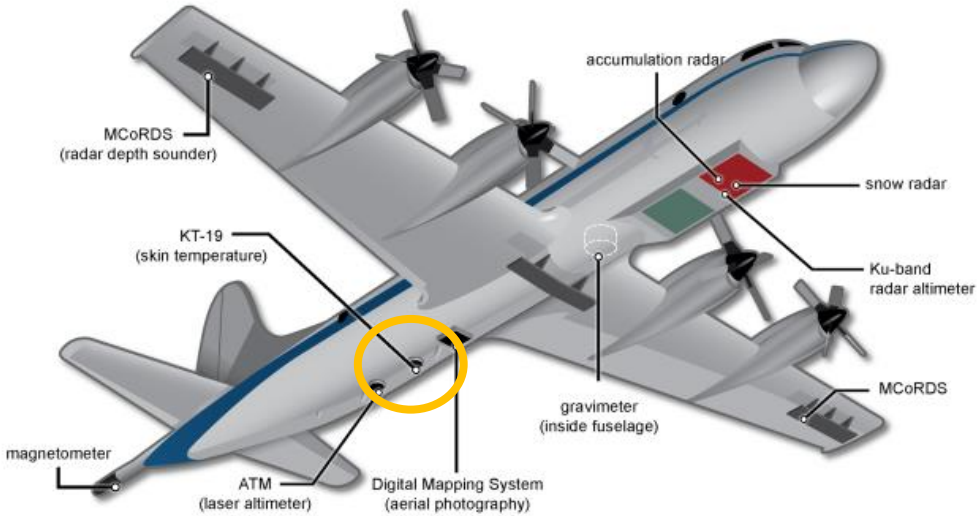
VALIDATION AGAINST ICEBRIDGE

- Operation Icebridge
  - Airborne measurements
  - KT19 radiometers with surface temperature
  - Snapshots during one day
  - Campaign: April-May, 2012



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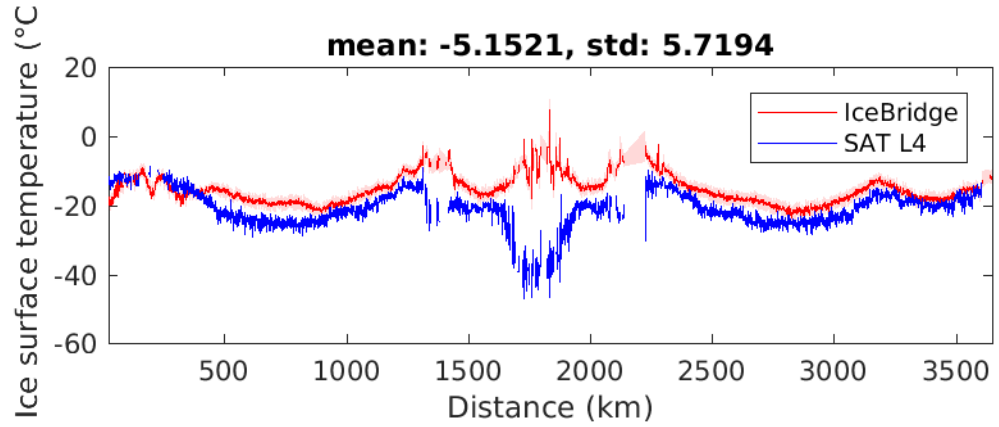
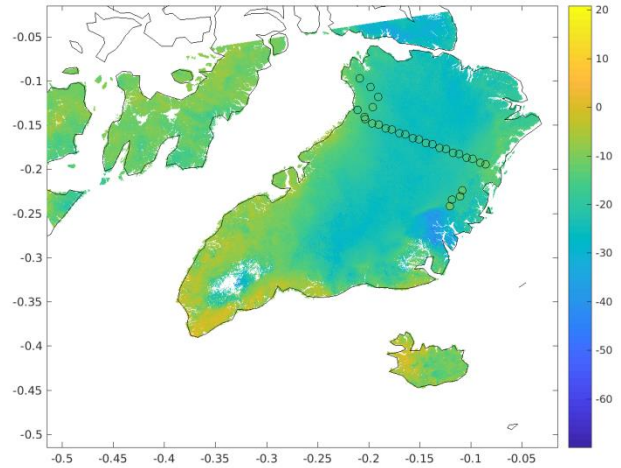
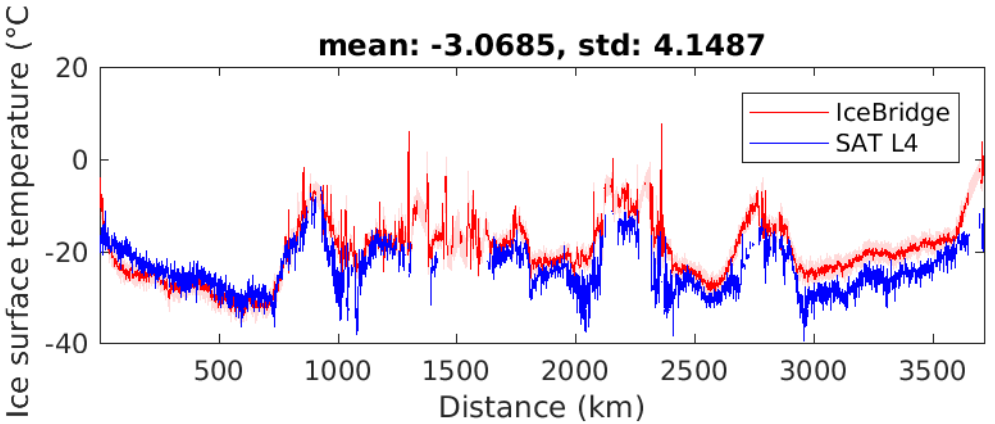
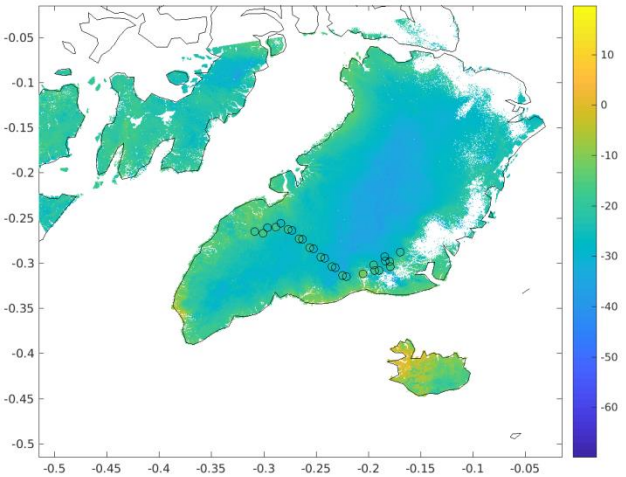
MODIS LEVEL 3 VALIDATION









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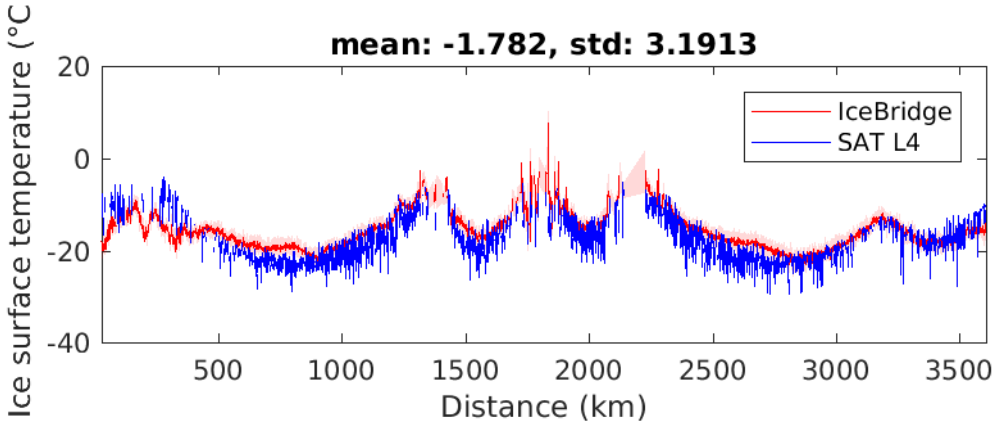
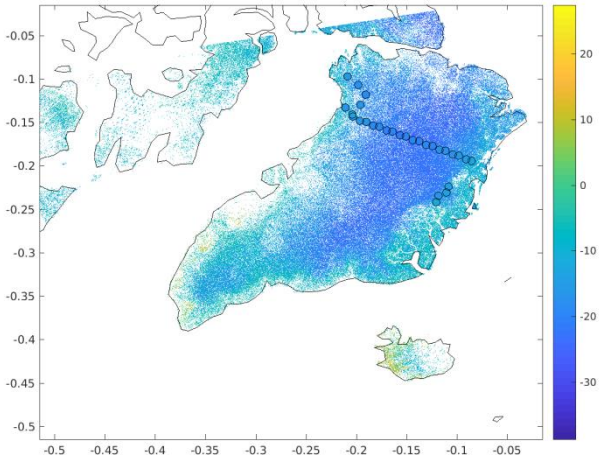
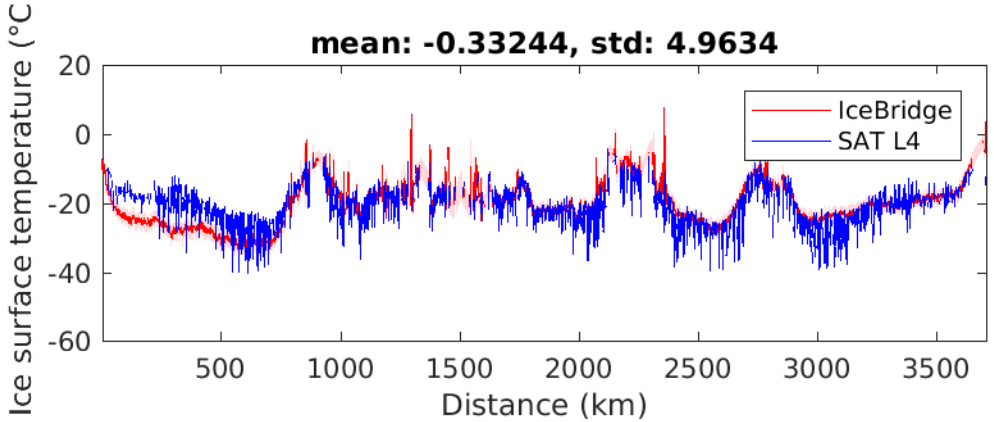
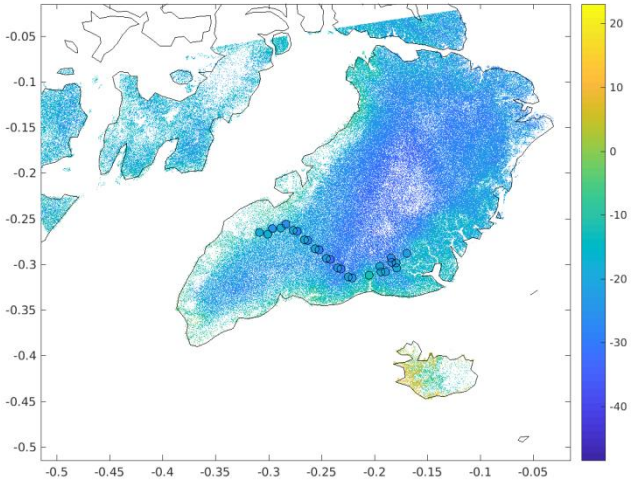
AVHRR GAC VALIDATION









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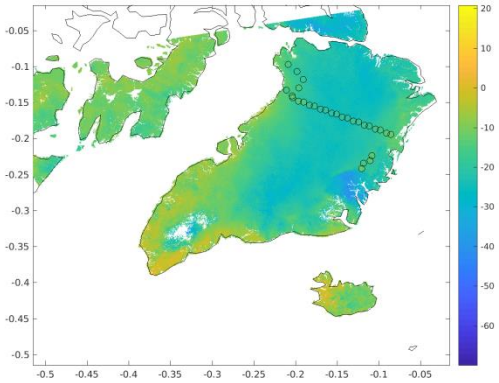
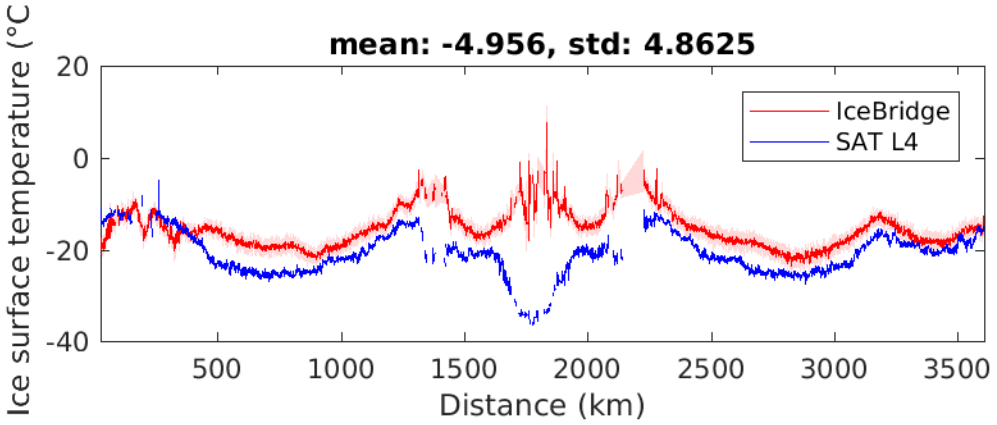
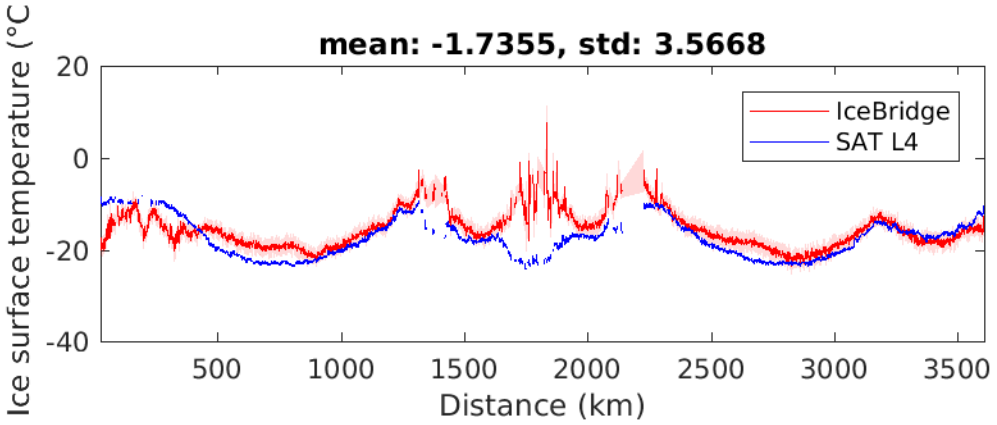
LEVEL 4 VALIDATION

- Several testruns (Modis + AVHRR GAC
  - No adjustment
  - Adjustment to AVHRR GAC
  - Further validation against Promice observations







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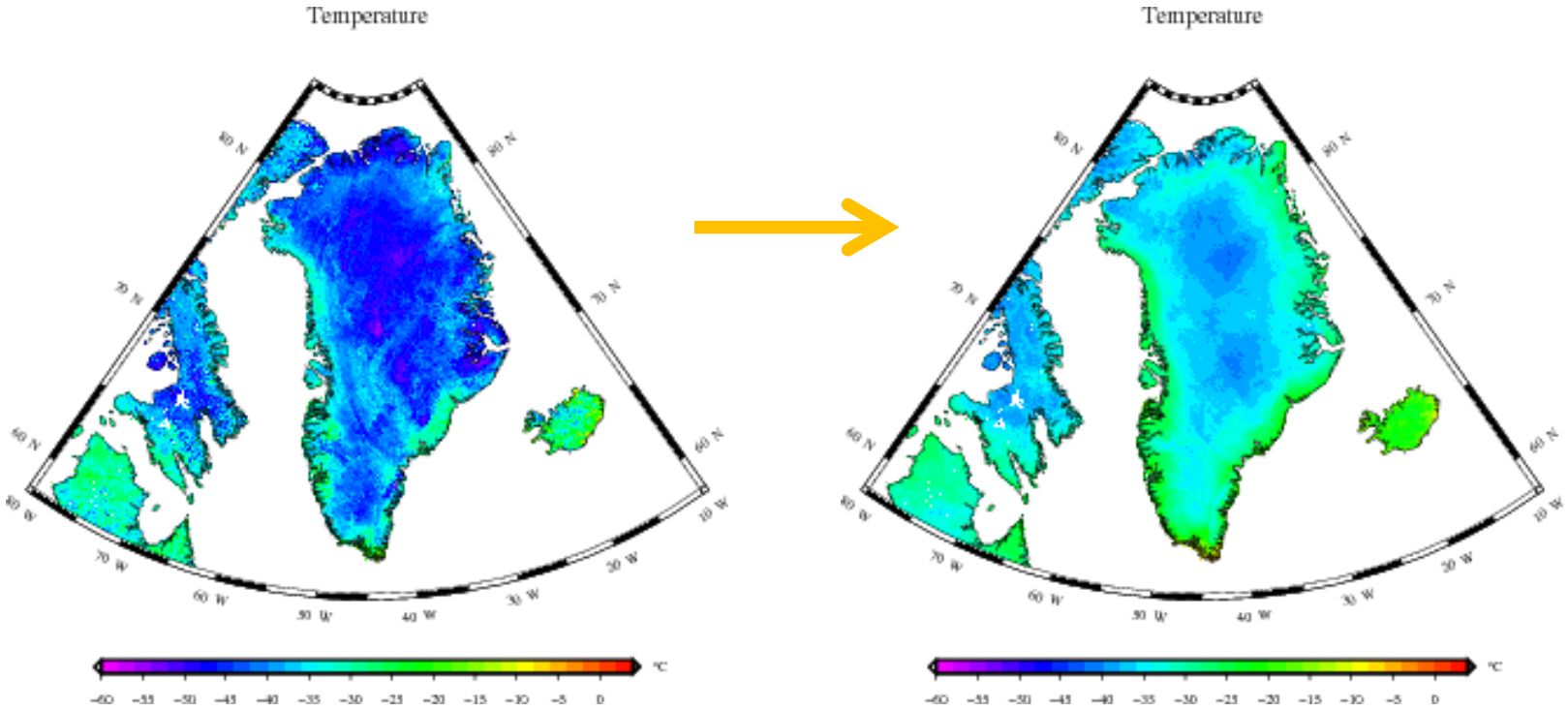
LEVEL 4 SETUP

- Spatially varying background errors
- 0.01 deg lat, 0.02 deg lon
- Daily estimates of skin surface temperatures
- Dynamical referencing towards AASTI AVHRR GAC observations
- Leave out AATSR LST observations



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Regional Climate and Surface Mass Balance Modelling

HIRHAM5: Combination of HIRLAM8 dynamics and modified ECHAM5 physics

31 levels in the atmosphere; 5km standard horizontal resolution

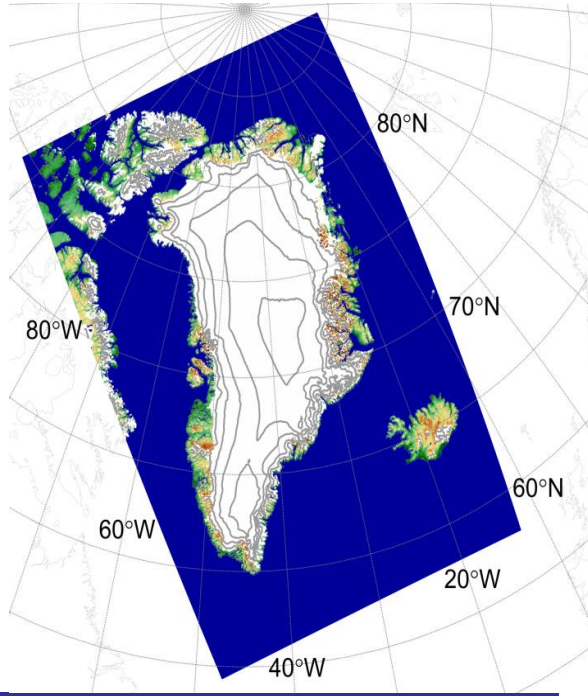
Surface Mass Balance based on full surface energy balance includes retention, refreezing and firn aquifers

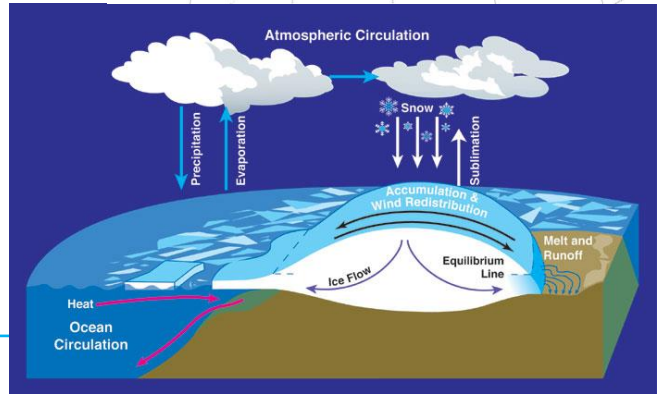
MODIS albedo already assimilated over glaciers as well as internal albedo scheme

Offline firn and surface mass balance model with 60 layers down to 100m w.e., snow densification, age related albedo, retention and refreezing parameterisations

Simulation output available to download from:

http://prudence.dmi.dk/data/temp/RUM/HIRHAM/GL2/





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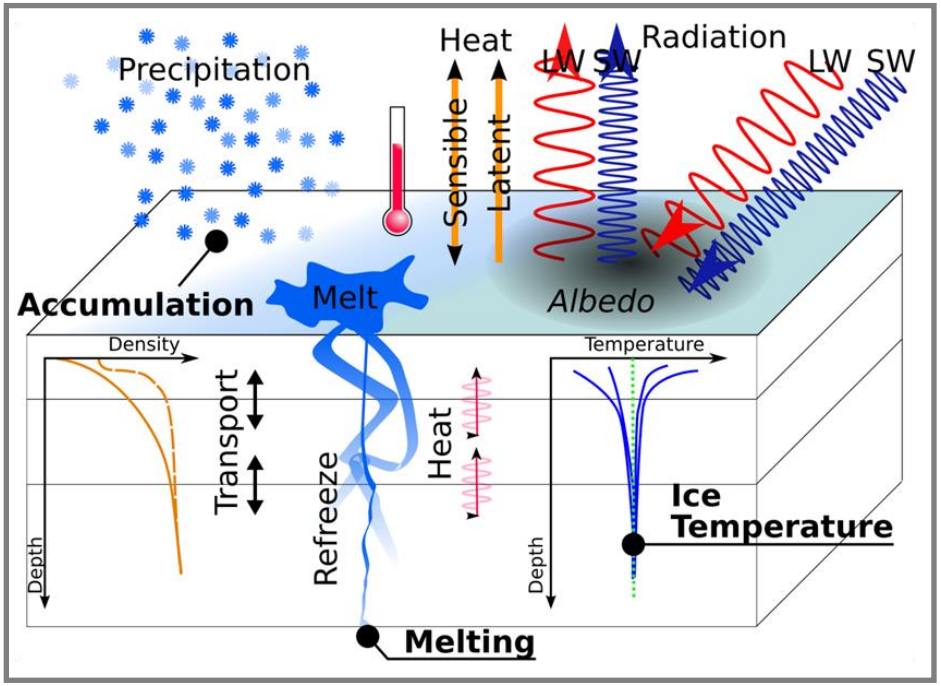
SMB WITH LST: WORK PLAN

Assess differences in TSURF between HIRHAM + HIRHAM-LST

Assess model performance with Promice/GC-NET observations



Other planned applications:

Vegetation + permafrost dynamics (CENPERM)
Hydropower planning (Asiaq)
Possible fire risk project in planning stages

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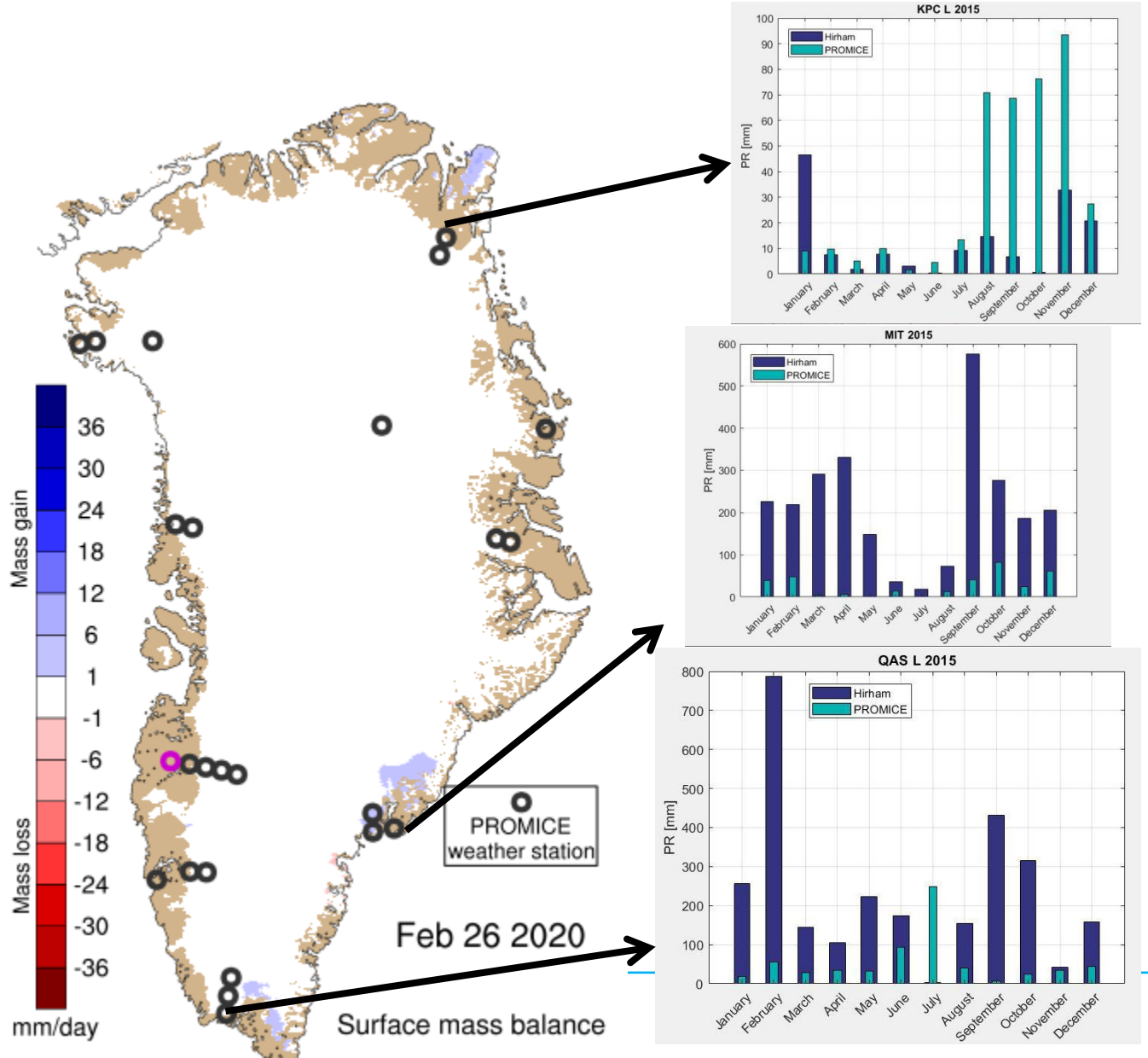
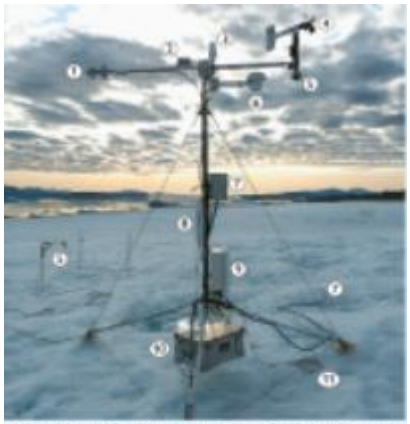
SELECTED PROMICE STATIONS





: solar and infrared radiation, 2: tilt sensor, 3: satellite
ntenna, 4: wind speed & direction, 5: snow/ice surface
eight, 6: air temperature & humidity, 7: ice ablation
ose', 8: solar panel, 9: data logger, barometer and
PS, 10: battery, 11: ice temperature profile (8 levels)

FUTURE WORK

- **Validate full year of L3 and L4 products**
- **Evaluation of HIRHAM5 regional climate model surface temperature.**
- **Implementation of LST observations into HIRHAM model**
- **Snowpack model simulations**
- **Reporting and article writing, submit paper end of 2020**

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CONCLUSIONS

- Nice and easy to use satellite products from LST CCI
- Could be nice with documented uncertainties
- (A)ATSR observations more challenging due to low sampling and diurnal variability in Tskin
- Need for documented validation and harmonization of different satellite products and CDRs

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CONCLUSIONS

Thanks, Questions ?

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