UNIVERSITY OF LEICESTER

Towards a Combined Surface Temperature Dataset for the Arctic from the Along-Track Scanning Radiometers (ATSRs)

Emma Dodd, Karen Veal, Darren Ghent, Gary Corlett, and John Remedios

1. Introduction

Surface Temperature (ST) changes in the Polar Regions are predicted to be more rapid than either global averages or responses in lower latitudes. Observations increasingly confirm this for the Arctic. It is, therefore, particularly important to monitor Arctic climate change. We have combined land, ocean and sea-ice surface temperature retrievals from ATSR-2 and AATSR to produce a new surface temperature dataset for the Arctic; the ATSR Arctic combined Surface Temperature (AAST) dataset. ST uncertainty estimates are included in AAST V2.0.

2. Method

- Define four main Arctic surface types:
  - open-land, land-ice, open-ocean and sea-ice.
- Use a **Masking algorithm (Fig. 1.)** to determine surface type, choose the ST retrieval algorithm and detect cloud.
- Use the most accurate ATSR ST data:

Land Surface Temperature (LST) and Ice Surface Temperature (IST)

GlobTemperature 1 km L2 Land and Sea-ice ST (GT_ATS_2P)[1]

Available through the GlobTemperature Data Portal

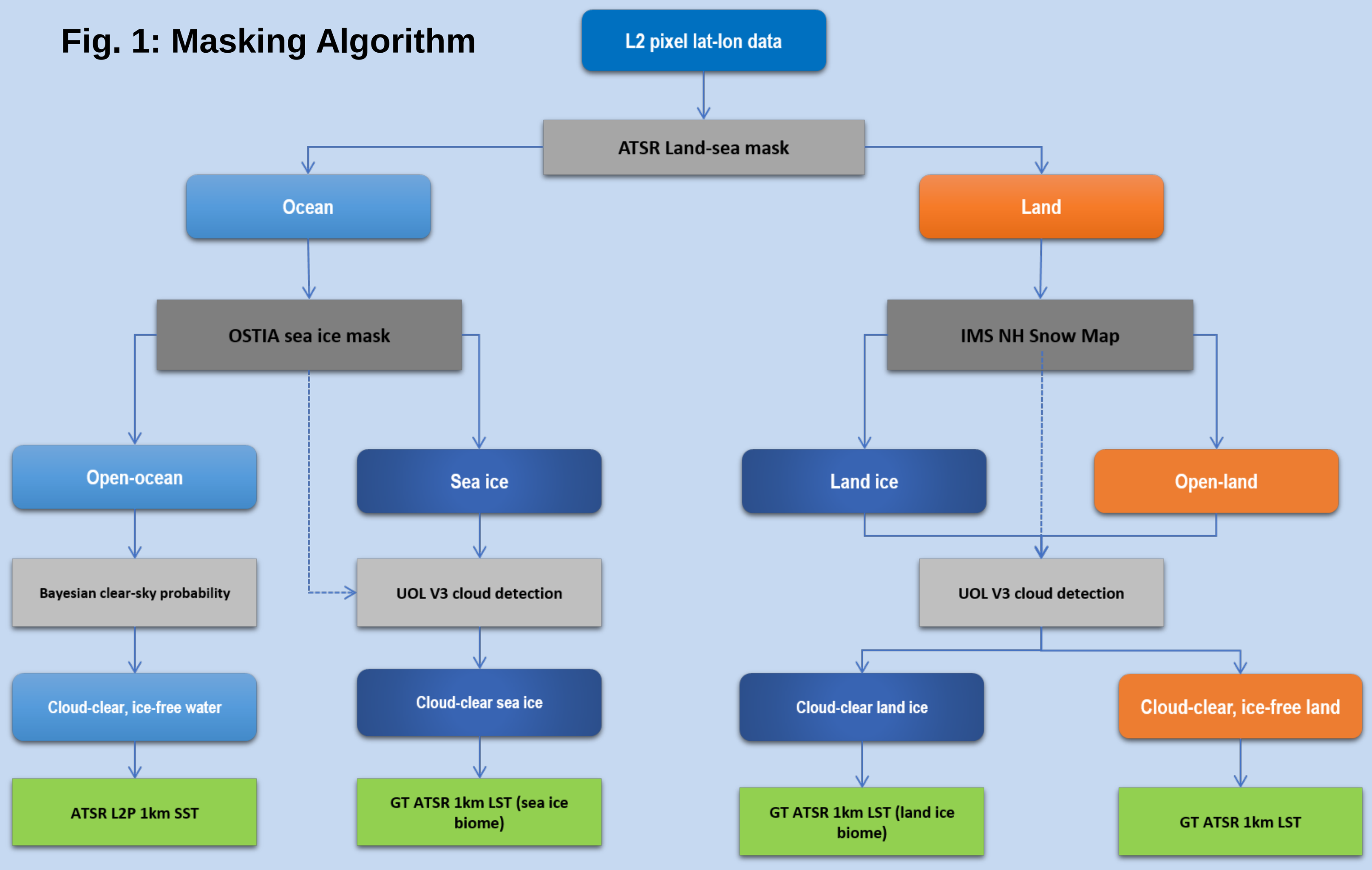
Sea Surface Temperature (SST)

ATSR 1km L2P SST

Based on methods used for the ATSR Reanalysis for Climate (ARC) 1 km L2P SST[2]

Available from the Centre for Environmental Data Archival (CEDA)

Fig. 1: Masking Algorithm



3. Validation, Comparison and Uncertainties

- Input STs were validated against in situ STs (Fig 2.).
  - ISTs agree with a median difference of -1.57 K, -0.38 K, -0.64 K over land, ice sheet and sea ice respectively (Fig.3).
  - LSTs agree with a median difference of 0.11 K (Fig.3).
  - SSTs agree with a median difference of -0.14 K (Fig.3).
- STs generally showed good agreement with those from MODIS[3,4].

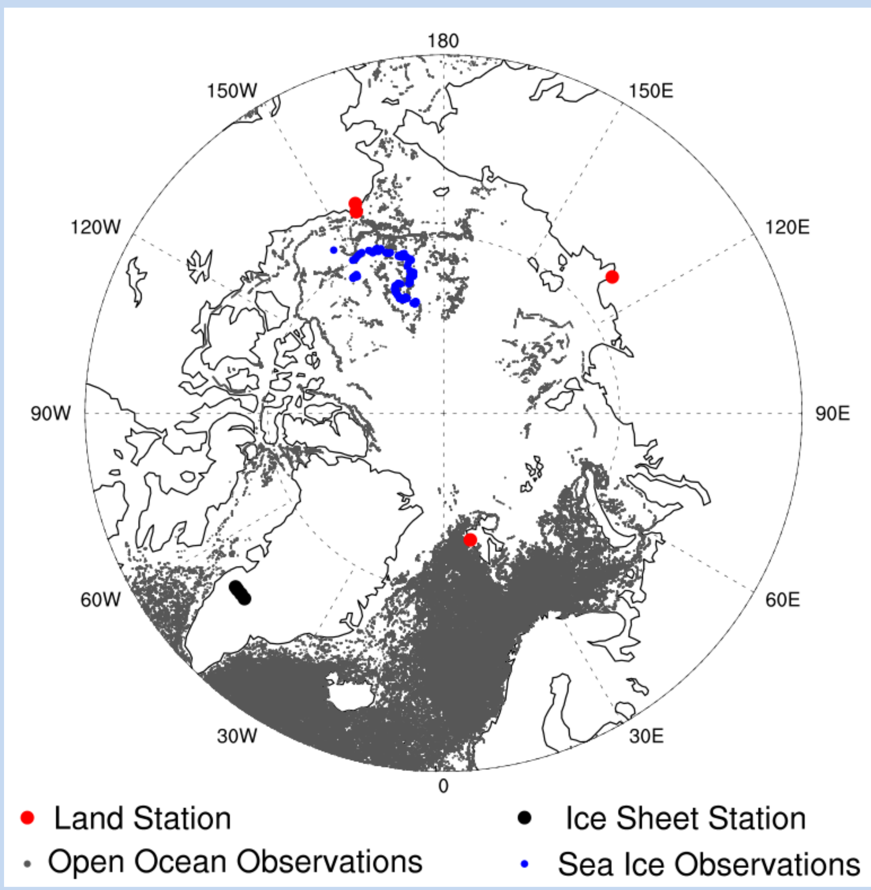


Fig. 2: The location of in situ validation stations.

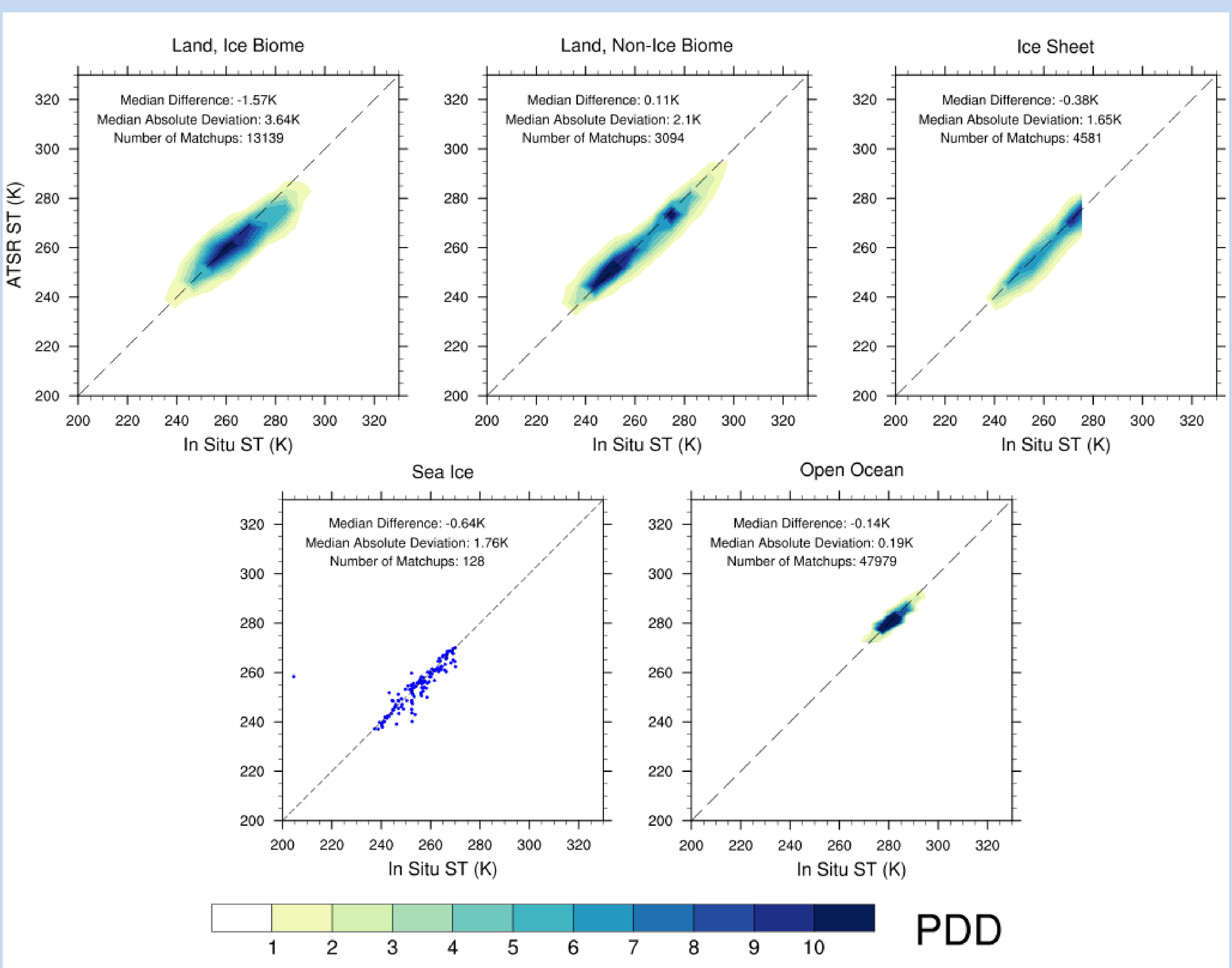


Fig. 3: Validation results across all years of ATSR-2 and AATSR data above 50°N.

4. Results

- The AAST dataset is comprised of separate sensor products (ATSR-2 and AATSR) as the inputs are not harmonised between sensors.
- There is good coverage of STs over a month, despite the narrow swath of ATSR instruments (Fig. 4).
- Mean Arctic STs increased between 1995 to 2012 (Fig. 5).

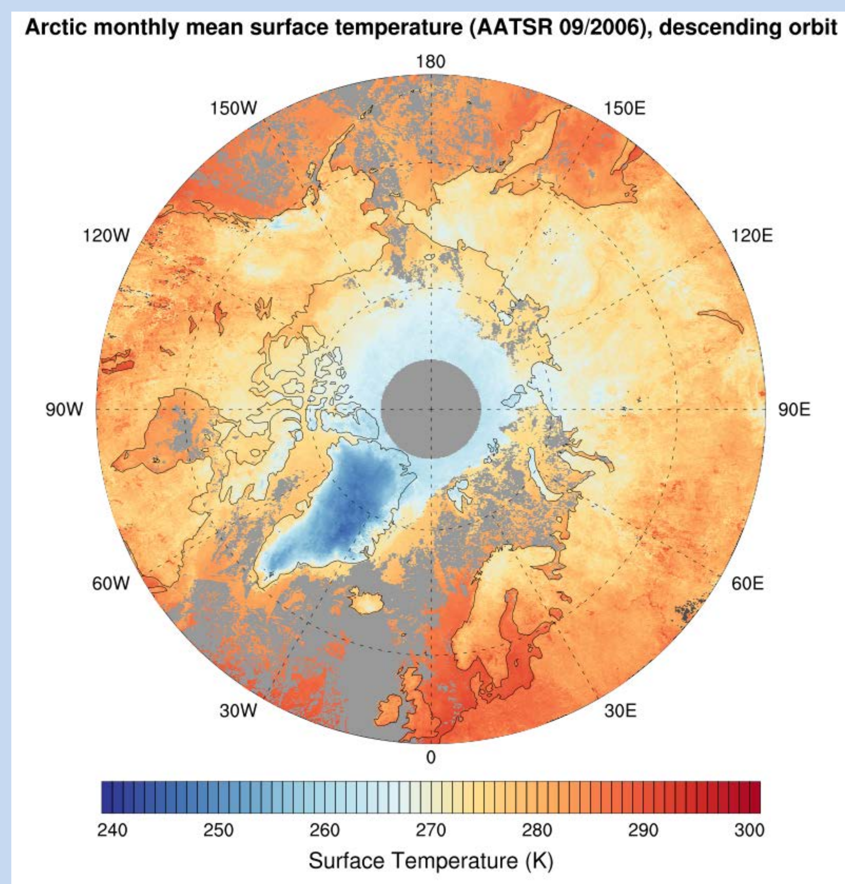


Fig. 4: Arctic monthly mean surface temperature for September 2006 from AATSR.

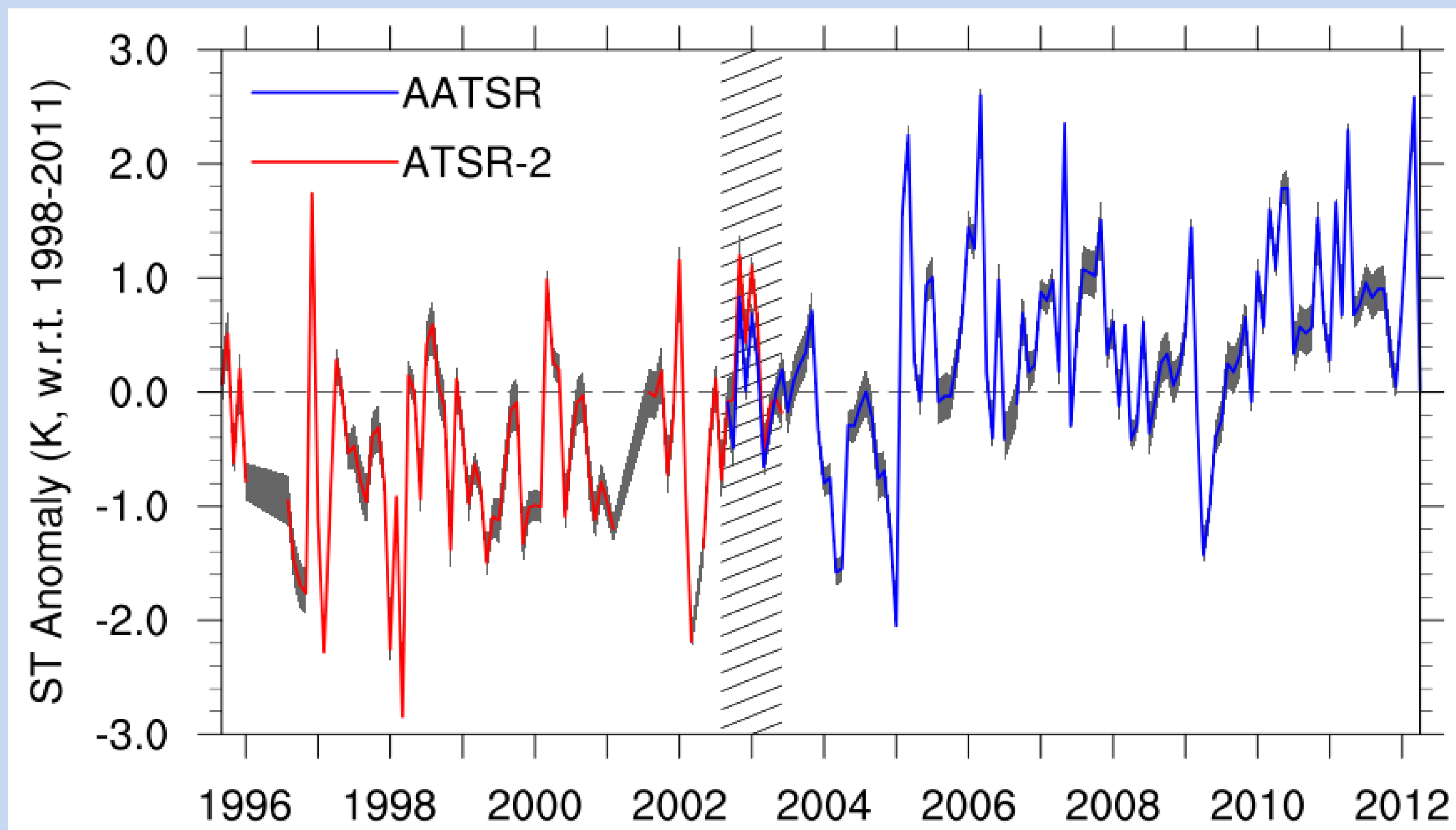


Fig. 5: Timeseries of monthly mean ST anomaly above 65N produced from the AAST dataset. Hatching indicates the overlap period of ATSR-2 and AATSR. Grey shading indicates uncertainty estimates.

5. Conclusions and Future Work

The Arctic ATSR Surface Temperature dataset is potentially a useful tool for model validation and regional climate studies. V2.0 of the AAST dataset is available to users via the GlobTemperature data portal.

6. References

1. Ghent D., Land Surface Temperature Validation and Algorithm Verification (Report to European Space Agency). 2012 (UL-NILU-ESA-LST-VAV).
2. Merchant, C. J., et al. 2012."A 20 year independent record of sea surface temperature for climate from Along-Track Scanning Radiometers." *Journal of Geophysical Research: Oceans (1978–2012)* 117.C12.
3. Hall, D. K. et al. 2004. "Sea ice surface temperature product from MODIS" *IEEE Transactions on Geoscience and Remote Sensing.* 42(5).
4. Wan, Z. 2008. "New refinements and validation of the MODIS land-surface temperature/emissivity products" *Remote Sensing of Environment*, 112(1).

Contact: Emma Dodd, University of Leicester, emad2@le.ac.uk