Evaluating representativeness errors in verification against Arctic surface observations

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Outline

- Arctic: downward longwave radiation anomalies
- **Global:** 2-m temperature forecast skill

IASOA observatories



How much information about the larger Arctic area do IASOA observations contain?



→ assess the spatial 'footprint' of IASOA observations using model analyses (ERA-Interim)

Example: Ny-Ålesund, Svalbard (79N,12E)

0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.42 0.28 0.05 9.81 0.82 0.03 0.00 1.00 1.00 1.0 0.45 0.22 0.37 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.08 0.88 1.00 0.94 0.22 0.06 058 1.00 1.00 .00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.96 1.00 0.67 1.00 0.87 1.00 1.00 0.99 1.00 1.00 1.00 0.99 0.62 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 1.00 1.00 0.95 0.99 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.96 0.97 1.00 1.00 1.00 1.00 0.99 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.07 072 1.00 1.00 1.00 1.00 1.00 1.00 0.7 1.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.05 0.24 0 1.00 1.00 00 0.00 0.00 0.00 0.00 0.00 0.00 0.04 0.27 0.23 0.98 1.00 1.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.10 0.76 0.15 1.00 1.00 1.00 1.00 0.98 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.04 0.96 1.00 1.00 1.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.42 0.10 048 1.00 1.00 1.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.87 1.00 1.00 047 0.00 0.88 033 0 1 00 00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.45 0.06 0.33 1.00 1.00 0(56 0.05 0.00 0.52 0.50 A 29 0.00 0.00 0.93 0.99 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.02 0.25 0.00 0.97 0.97 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.06 0/69 1.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.04 0.06 1.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.02 0.99 083 1.00 1.00 0.00 0.00 0.00 0.00 1.00 1.00

HRES ($\Delta x=10 \text{ km}$)



ERA-Interim ($\Delta x=80$ km)

Downward longwave flux at Ny-Ålesund



Grid point	Land fraction	r
0	0.62	0.918
1	0.00	0.838
2	0.18	0.816
3	0.00	0.859

Systematic and non-systematic differences between grid-points

How much information about the larger Arctic area do IASOA observations contain?



 \rightarrow assess the spatial 'footprint' of IASOA observations using model analyses (ERA-Interim)



Spatial correlation of longwave flux at NyAlesund



Correlation within ERA-Interim

Correlation OBS v ERA-Interim

Correlation as a function of distance



Correlation as a function of distance



Variance explained by positive correlations



Barrow, Alert, Ny-Alesund

All IASOA stations

Longwave flux at Barrow OBS v ERA-I



Summer (May-Oct)

Winter (Nov-Apr)

Longwave flux at NyAlesund OBS v ERA-I



Monthly



Ny-Ålesund, Svalbard (79N,12E)

0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.42 0.28 0.05 0.81 0.82 0.03 0.00 0,22 0.37 1.00 1.00 1.0 0.45 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.08 0.88 1.00 0.94 0.22 0.06 058 1.00 .00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.96 1.00 0 67 1.00 0.87 1.00 1.00 1.00 1.00 0.05 1.00 0.99 1.00 1.00 1.00 0.99 0.62 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 1.00 1.00 0.95 0.99 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.96 0.67 1.00 1.00 1.00 1.00 0.99 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.07 072 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.05 0.24 0 1.00 1.00 00 0.00 0.00 0.00 0.00 0.00 0.00 0.04 0.27 0.23 0.98 1.00 1.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.10 0.76 0.15 1.00 1.00 1.00 1.00 0.98 1.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.88 0.04 0.96 1.00 1.00 1.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.42 0.10 048 1.00 1.00 1.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.87 1.00 047 0.00 0.88 1 00 00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.33 1.00 0.56 0.05 0.00 0.52 0.50 1 00 A 29 0.00 0.00 0.93 0.99 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.02 0.45 0.00 0.97 0.97 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.06 0/69 1.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.04 0.06 1.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.02 0.99 083 1.00 1.00 0.00 0.00 00.0 00.0 1.00 1.00

HRES ($\Delta x=10 \text{ km}$)



ERA-Interim ($\Delta x=80$ km)

Representativeness of daily DLR (Jan 2017)



Bias

Standard deviation

Estimation based on Taylor hypothesis



2-m temperature













Regional variations



Regional variations



Regional variations



Europe



Upscaling to ~400 km (4 deg)



Problem: strong surface inversions over snow

Upscaling to ~400 km (4 deg)



Problem: low stratus boundaries and persistence

Conclusions / applications

- Studying representativeness is a worthwhile endeavour ③
- Characteristics differ greatly between parameters
- Different approaches are being tested
- Scale-dependent verification (upscaling, FSS) provides insights

- → Spatial extrapolation of station observations
- → Assessment of 'footprint' of potential future obs sites
- → Estimation of improvements due to future resolution upgrades

Estimation based on Taylor hypothesis

