



Drifting snow in Adélie Land

A modelling study

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Methods

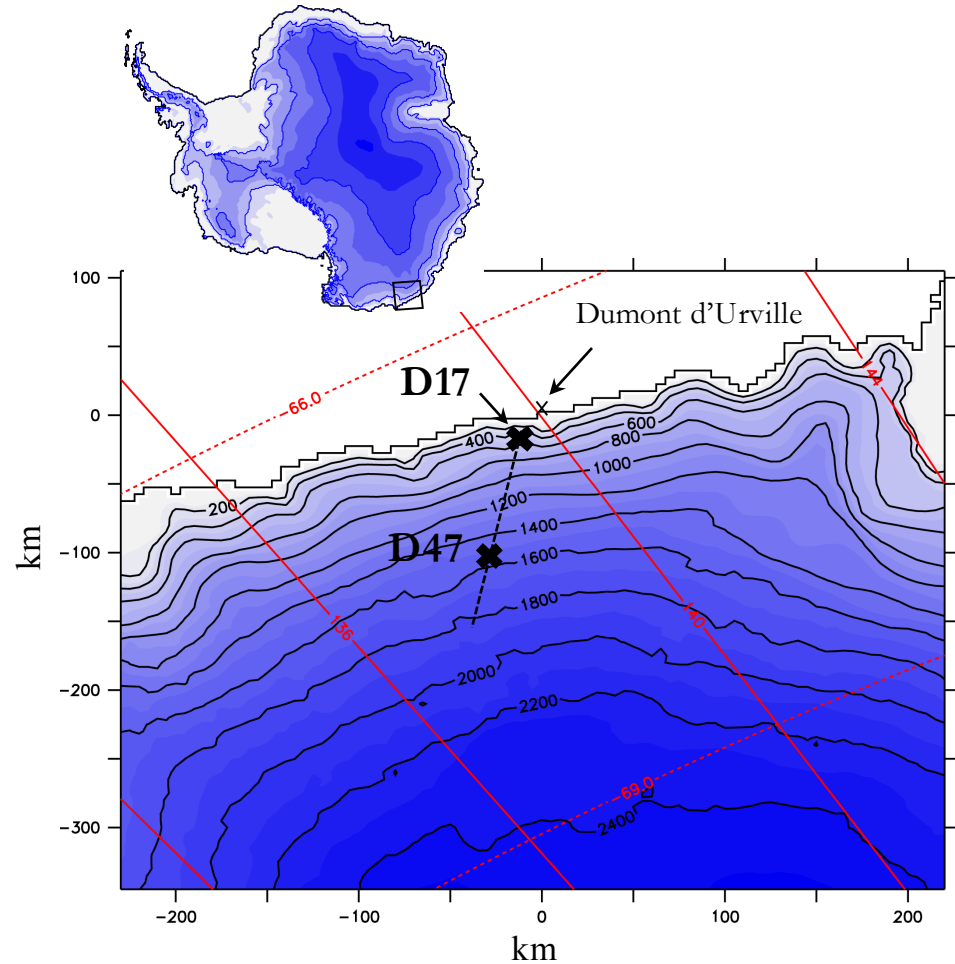


Fig. Topographic map of coastal Adélie Land.

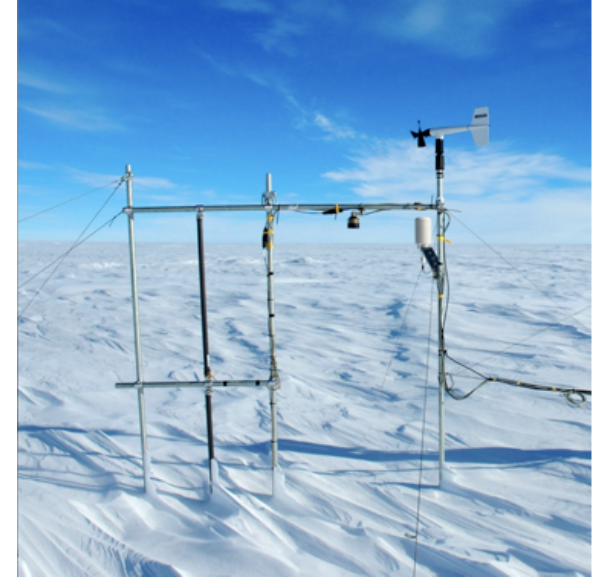
SMB (2004-2016)



D17 (2010-2016)



D47 (2010-2012)



Model MARv3.9

Specificities Developed for polar regions:

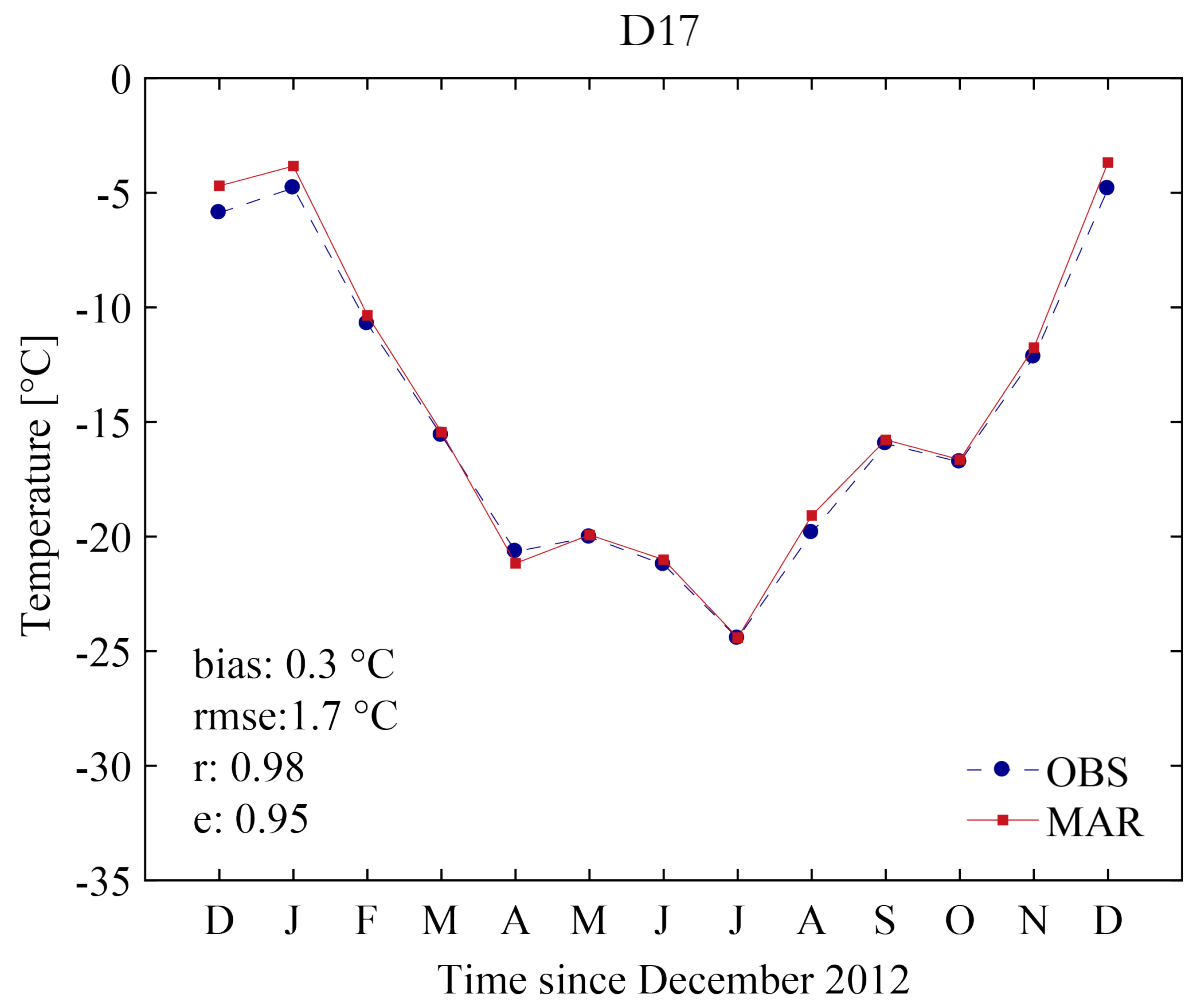
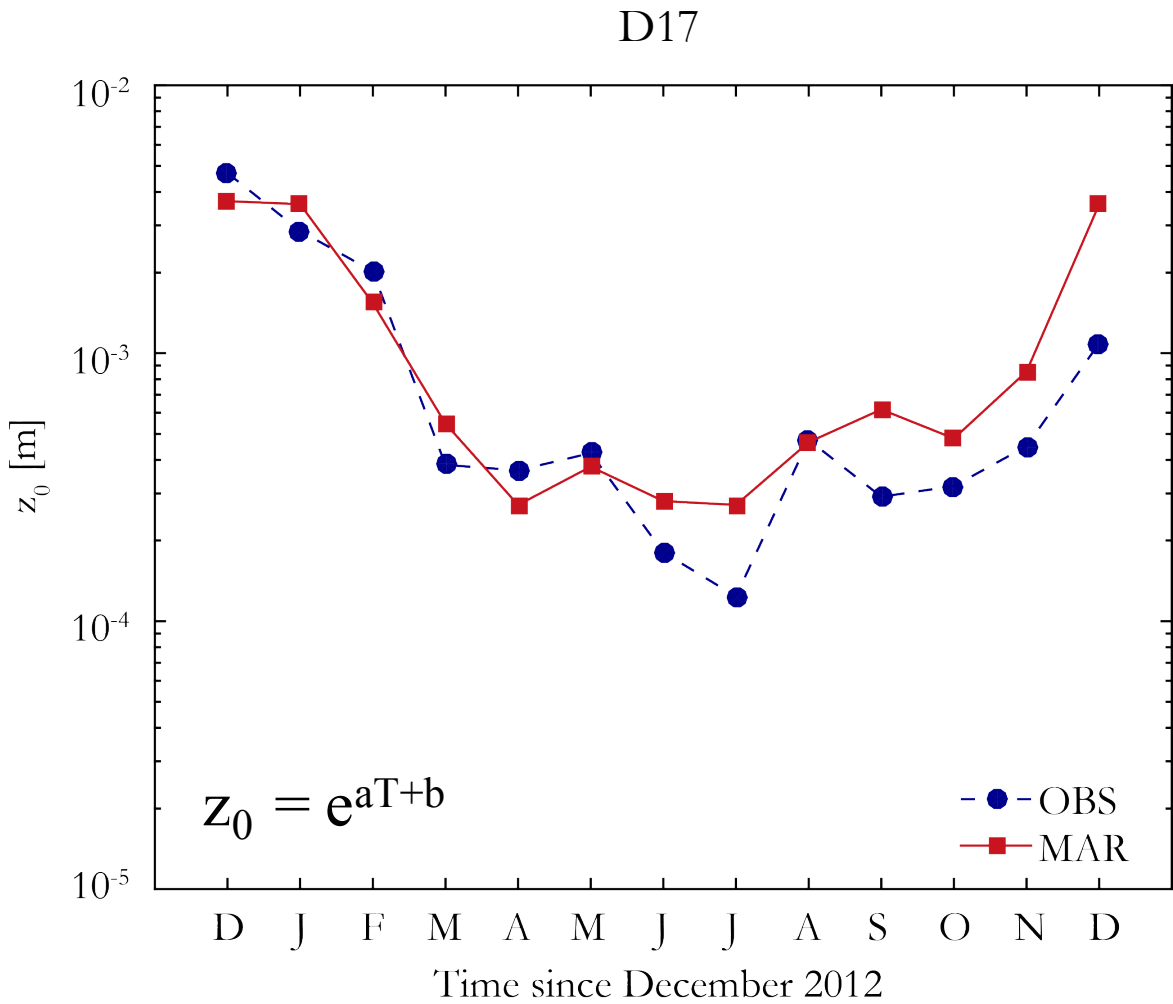
- Drifting snow routine
- Interactive snowpack model
- Stable boundary layer physics



Resolution 10 km, 24 levels ($z_1 = 1$ m, $z_2 = 2$ m)

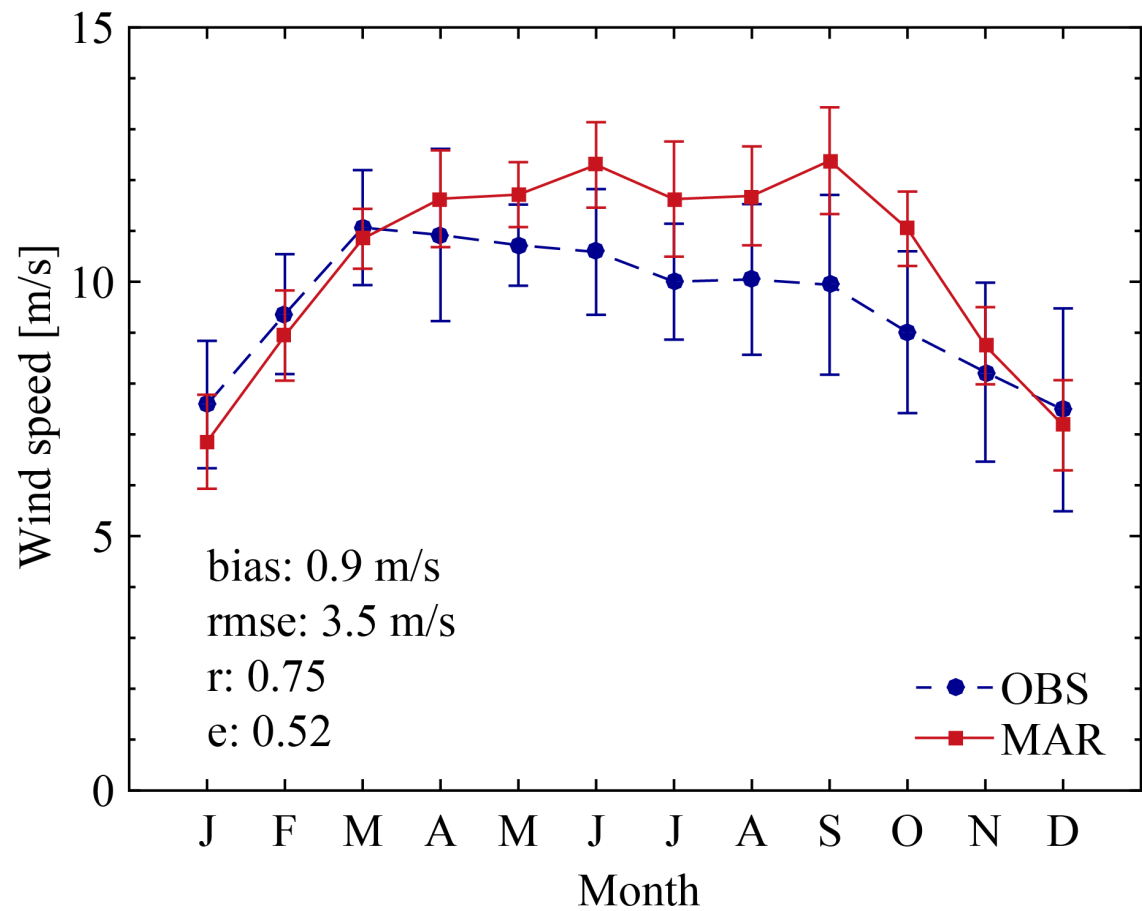
Forcing Era-Interim

Methods

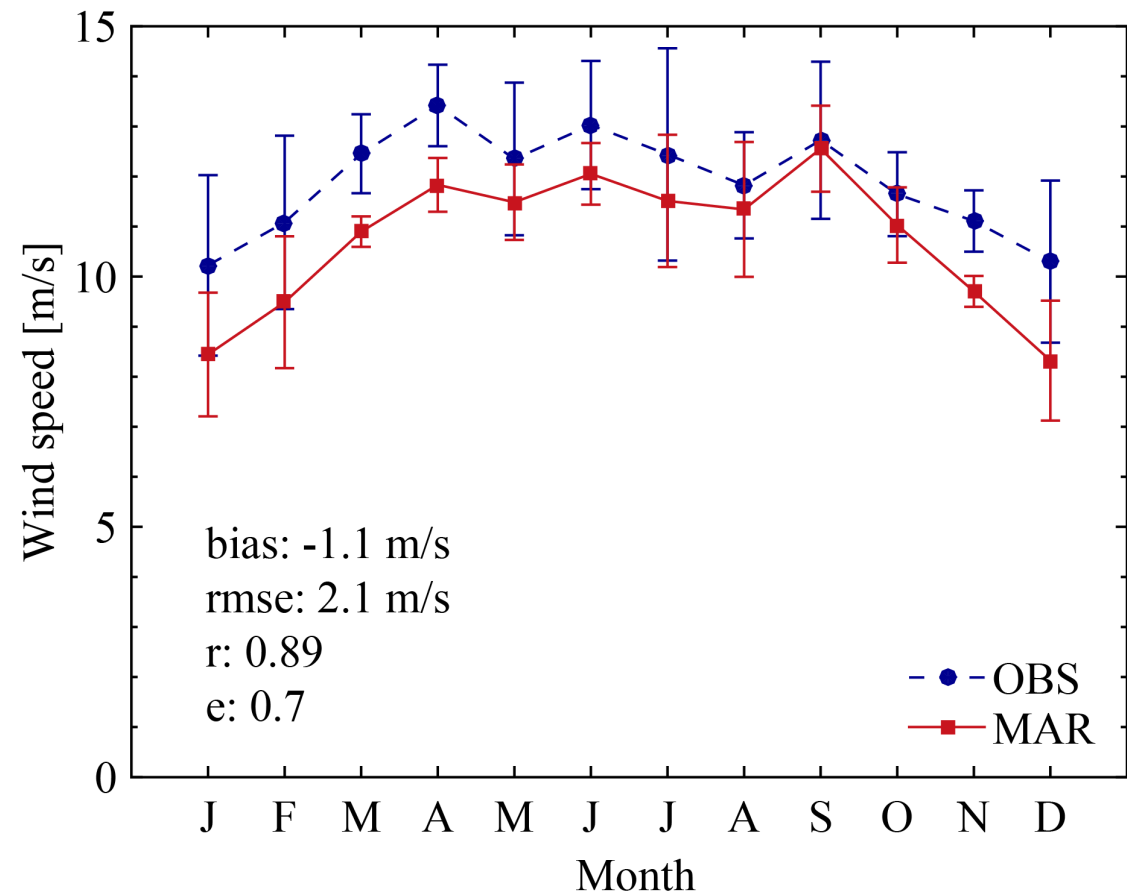


Near-surface wind speed

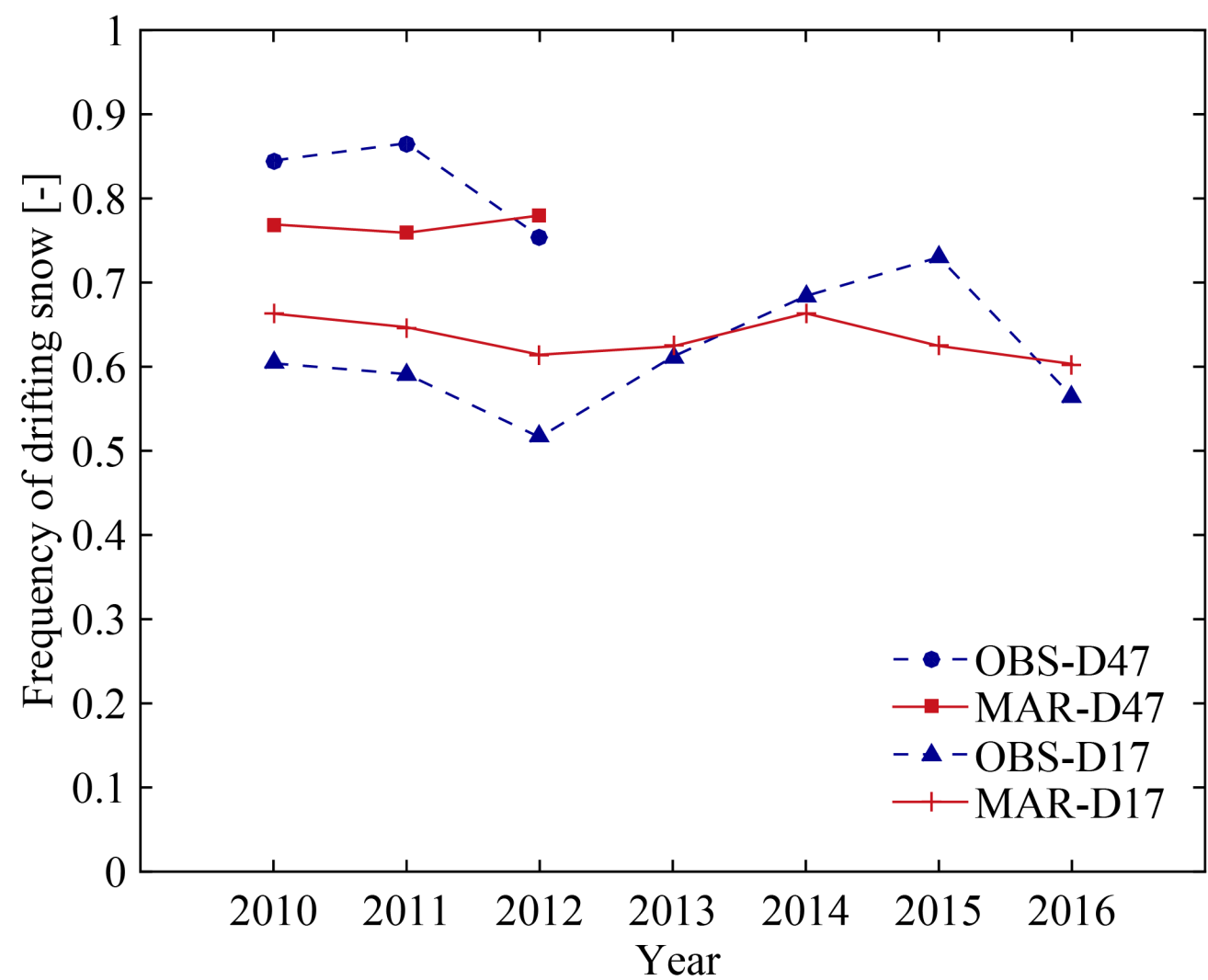
D17 (2010-2016)



D47 (2010-2011)



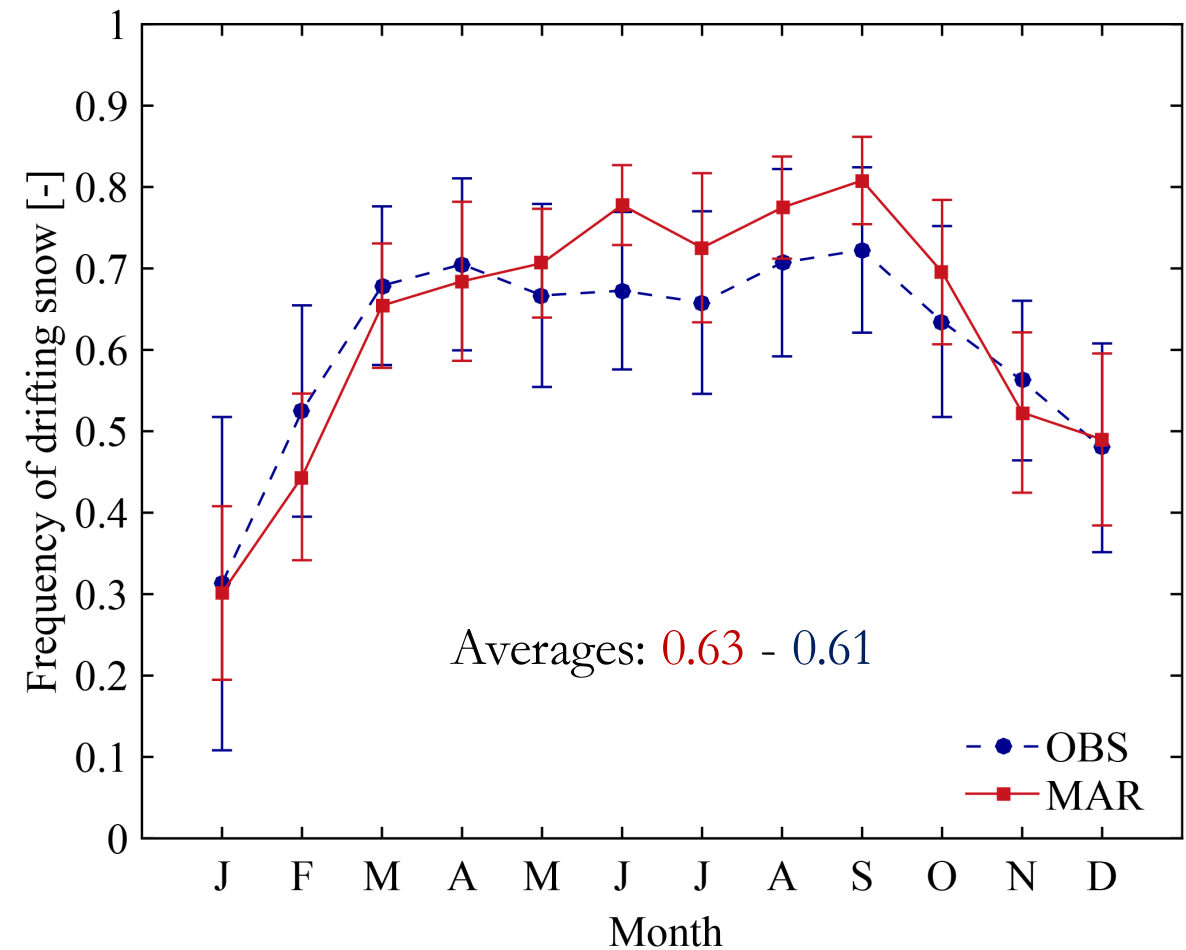
Inter-annual variability of DSF



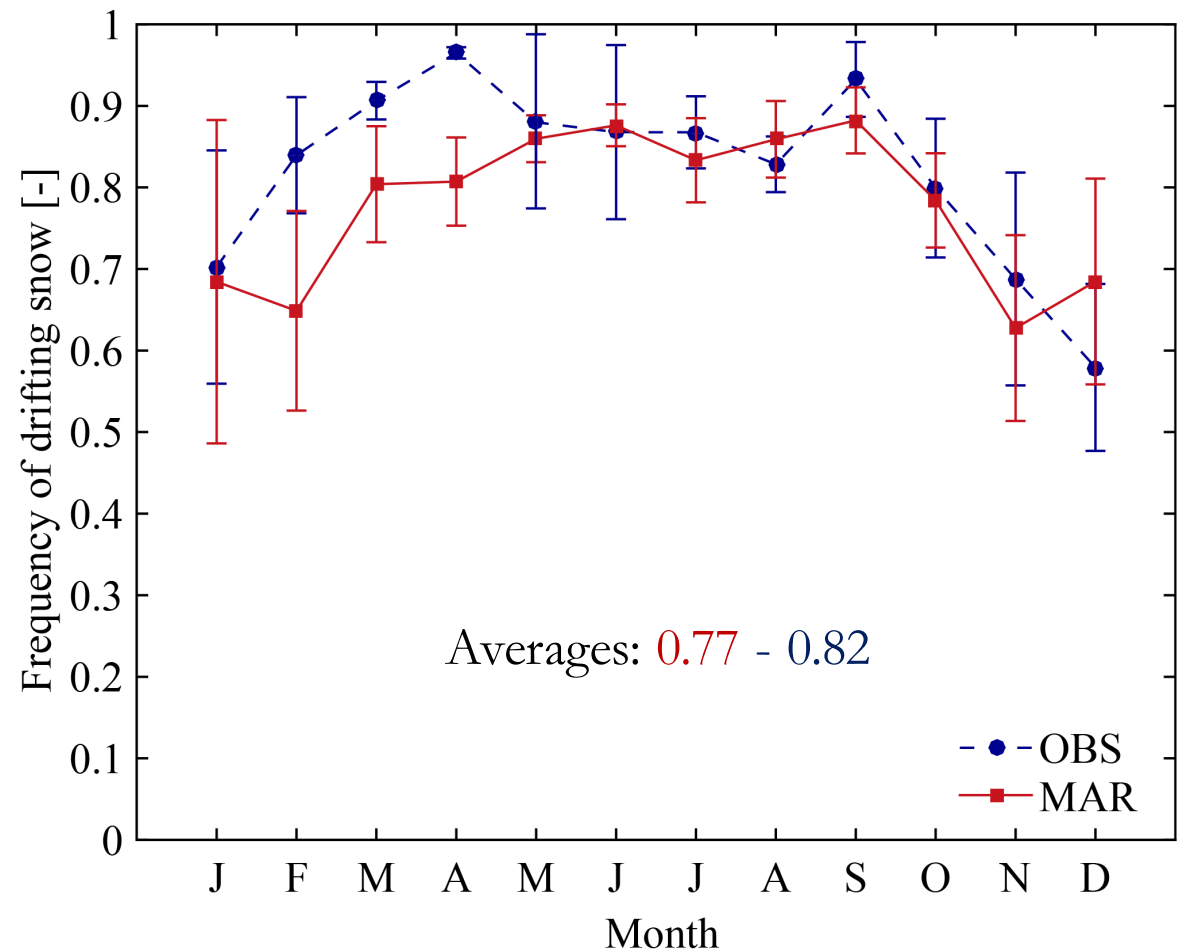
➤ Detection threshold set to $10^{-3} \text{ kg/m}^2/\text{s}$

Intra-annual variability of DSF

D17 (2010-2016)



D47 (2010-2012)



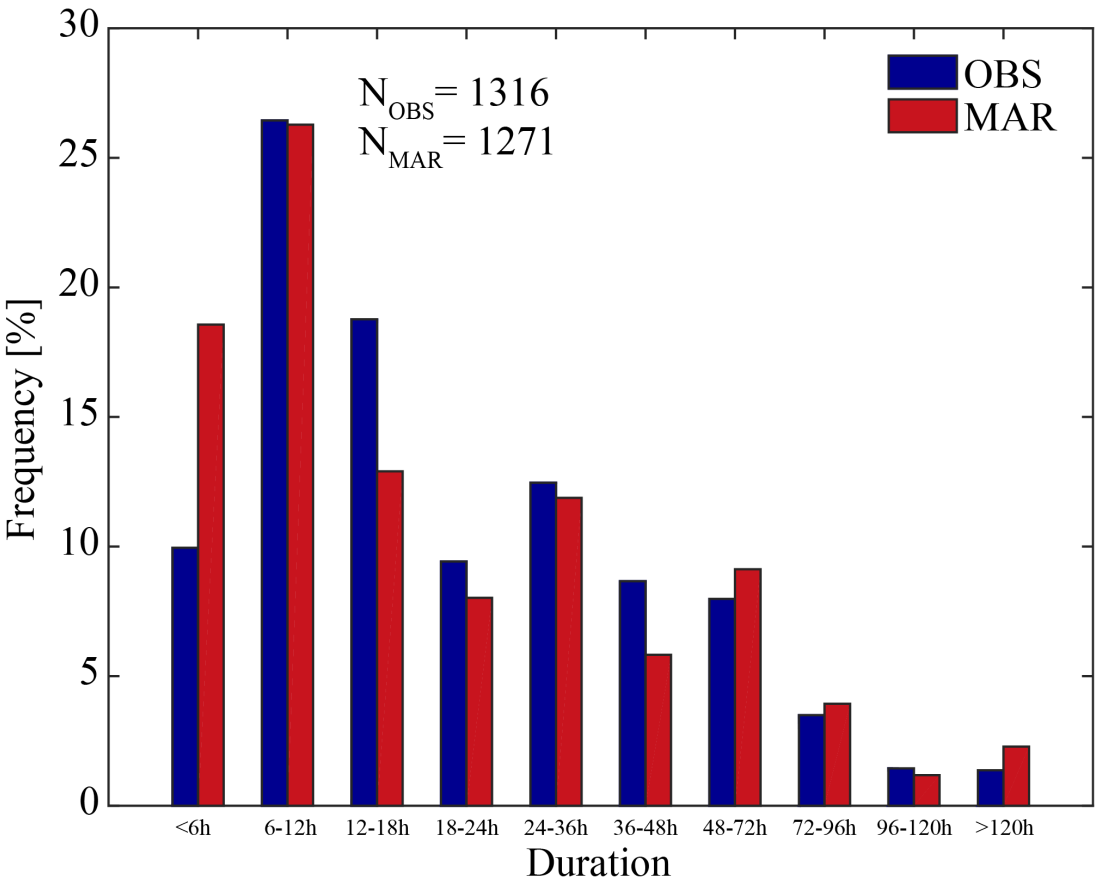
Duration of drifting snow events

➤ Minimum duration set to 4 hours (Vionnet et al. 2013)

D17 (2010-2016)

Mean duration: 26 h (OBS&MAR)

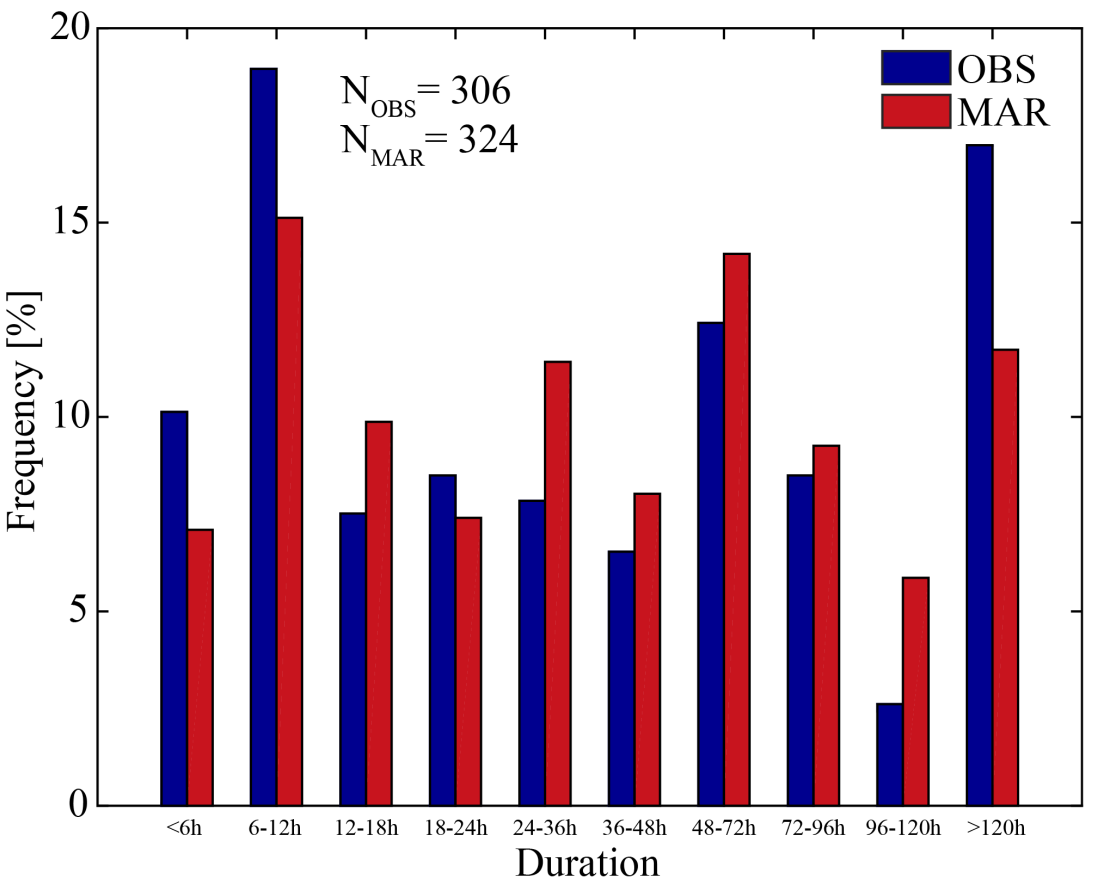
Max. duration: 10 days (OBS&MAR)



D47 (2010-2012)

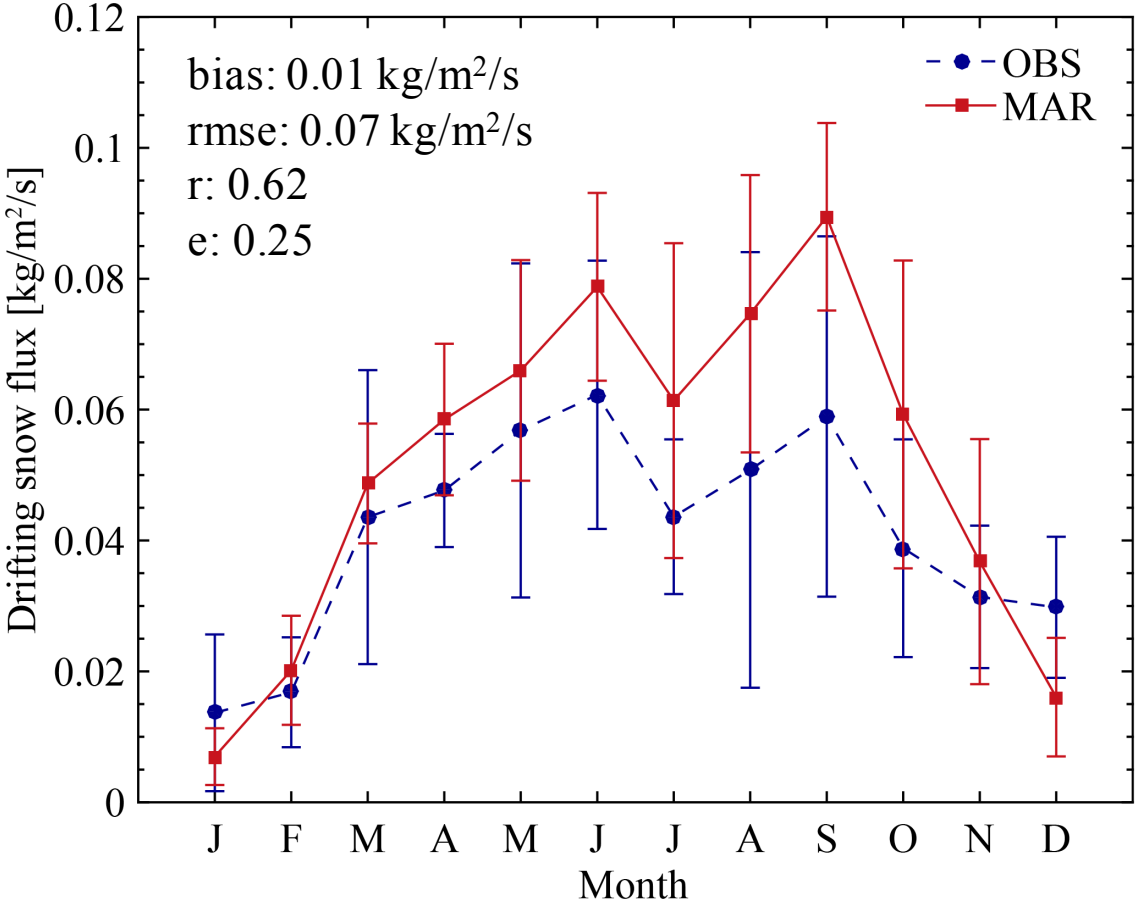
Mean duration: 67 h (OBS) / 56 h (MAR)

Max. duration: 26 days (OBS) / 17 days (MAR)

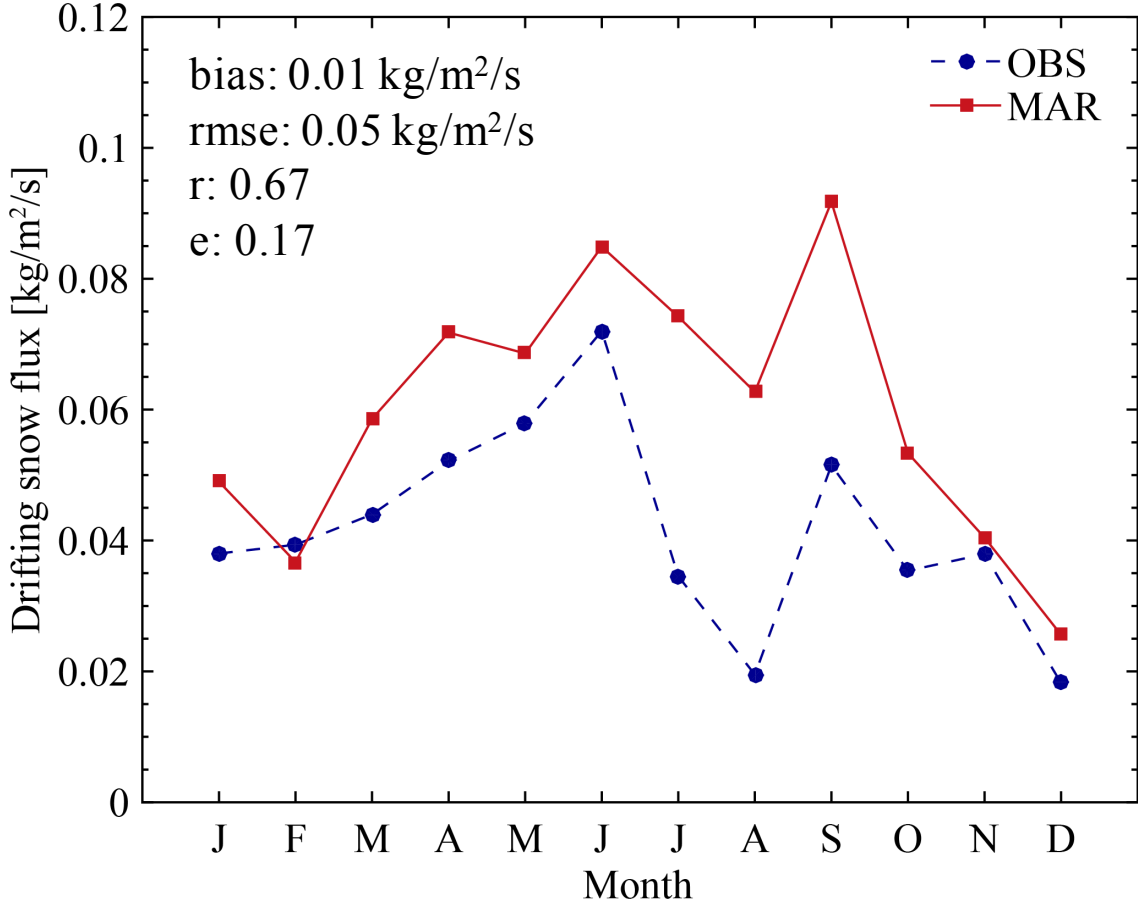


Snow mass flux

D17 (2010-2016)



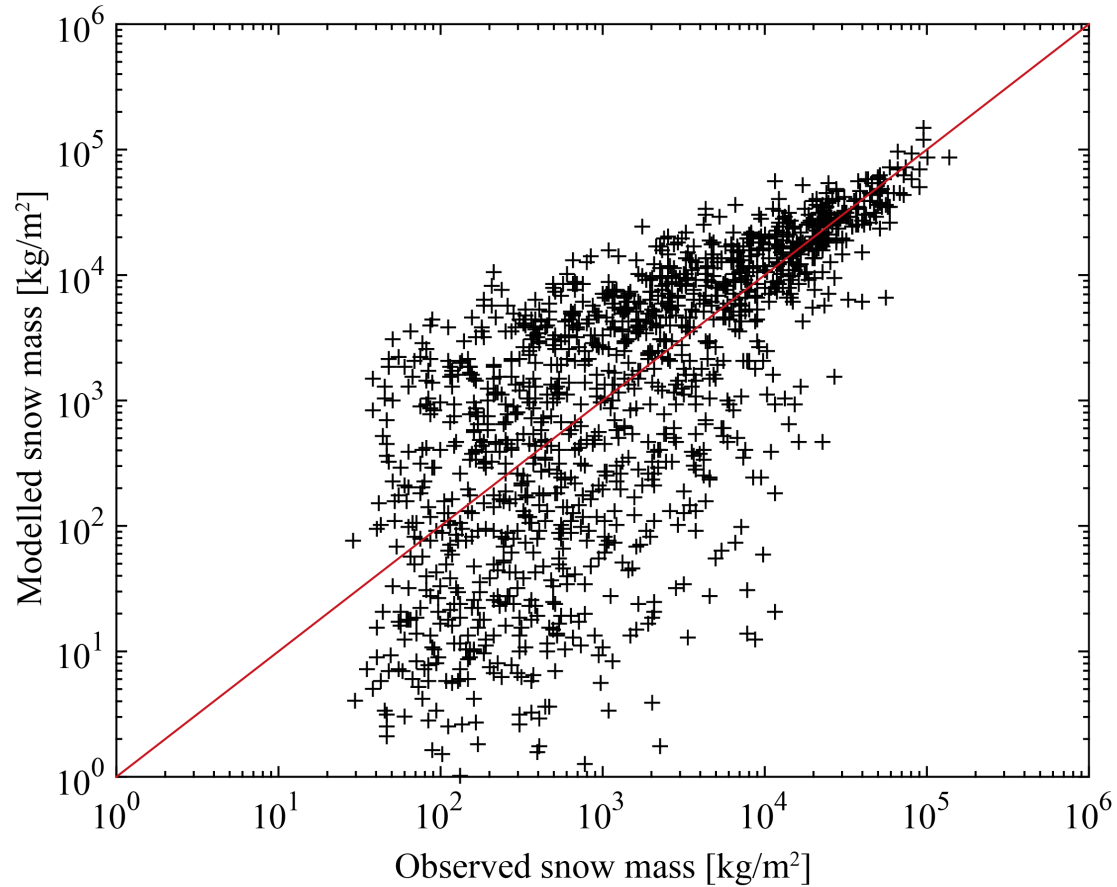
D47 (2010-2011)



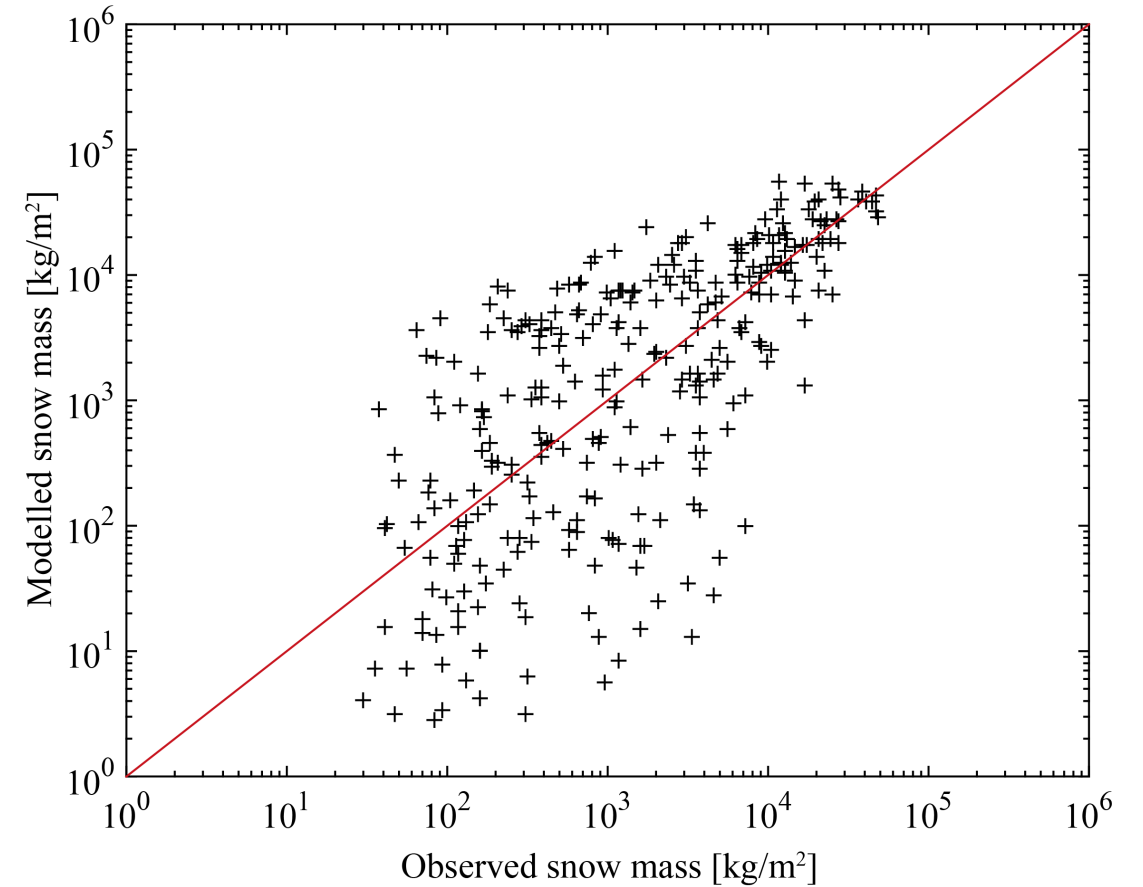
➤ Mean monthly bias of $10 \cdot 10^{-3} \text{ kg/m}^2/\text{s}$ (D17) and $18 \cdot 10^{-3} \text{ kg/m}^2/\text{s}$ (D47)

Mass transport per event

D17 (2010-2016)



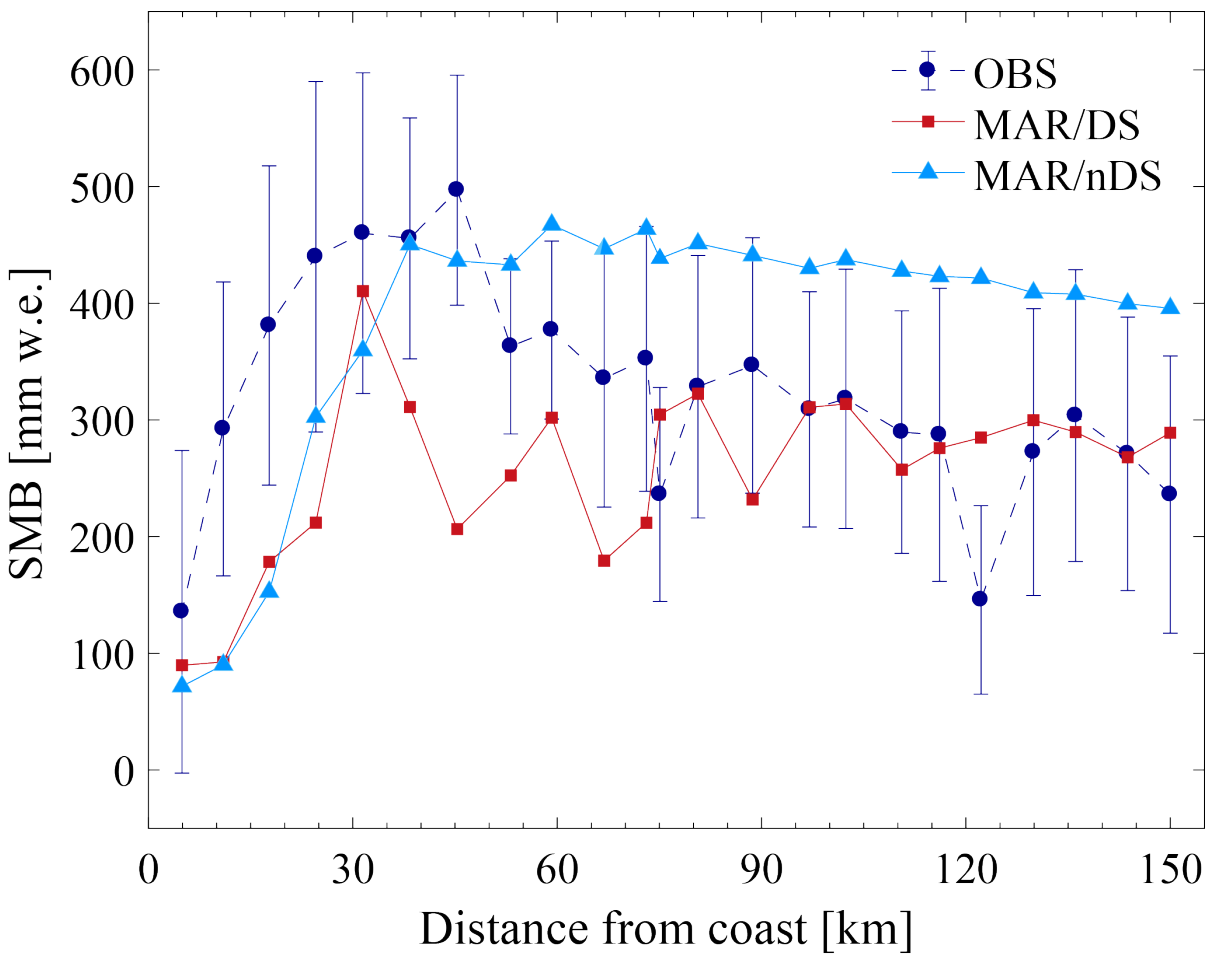
D47 (2010-2011)



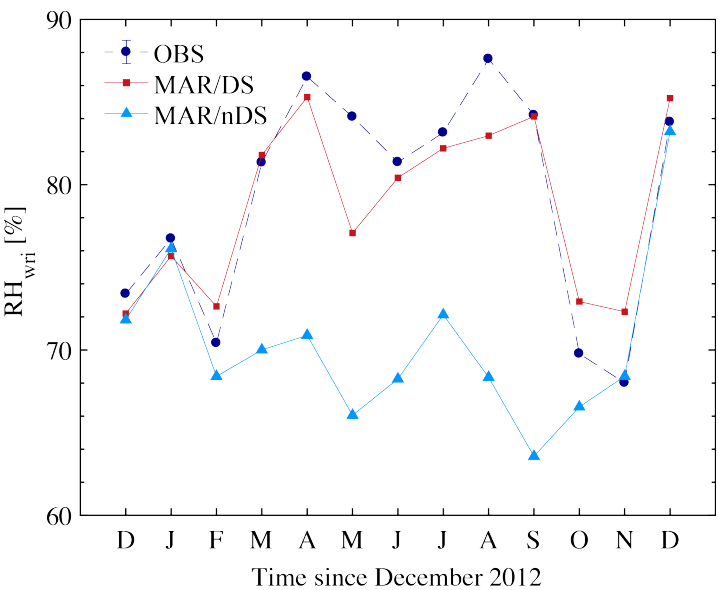
- Overestimation by a factor of 3 on average
- Total horizontal snow mass transport overestimated by $\sim 30\%$ at both locations

Surface mass balance

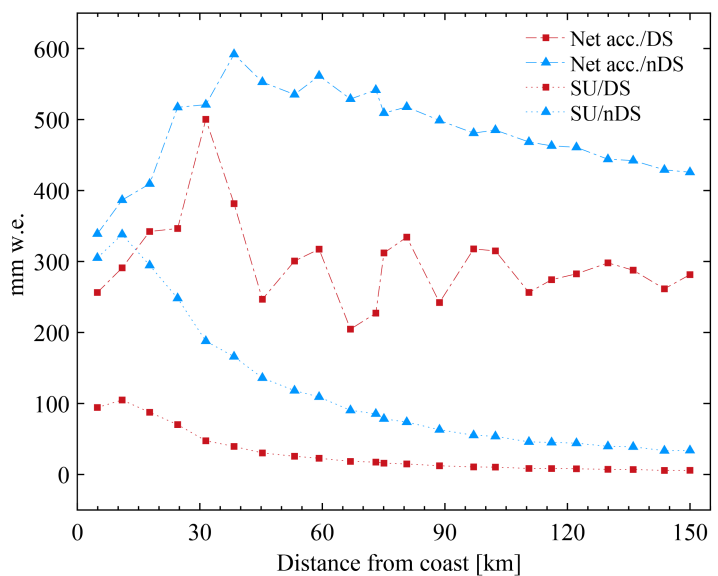
Transect (2004-2016)



D17 (2013)



Transect (2004-2016)



➤ See talk n° 1988, session CR7A on Wednesday

Summary

- Production of a drifting snow dataset for model evaluation (freely available very soon)
- High DFS values of 0.61 (D17) and 0.83 (D47) with a strong seasonal cycle and a low inter-annual variability
- MAR is able to reproduce realistic drifting snow characteristics and their spatial variability over long time periods
- MAR overestimates mass transport per event (x3) and total mass transport (30%) compared to (underestimated) OBS
- Better agreement with (SMB) observations when drifting snow is activated
- Next step = continental-scale SMB and climate studies

SPC vs 2G-Flowcapt™

