Supplementary for 'Inter-comparison of snow depth over sea ice from multiple methods'

Table S1 Information of CRREL and AWI buoys used in validation of snow products

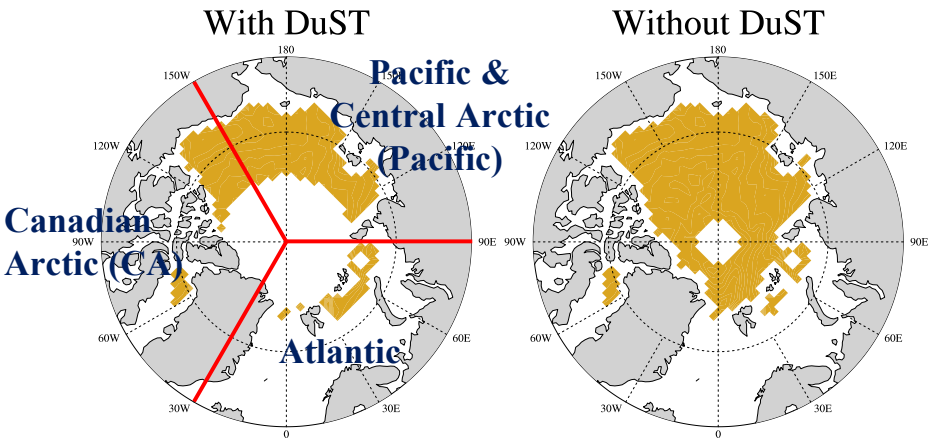
Buoy	Buoy number/date
CRREL	2002A, 2003A, 2003C, 2003D, 2004A, 2004B, 2004C, 2004D, 2005F, 2006C, 2006D, 2006E, 2007B, 2007C, 2007D, 2008B, 2008C, 2008 E, 2009A, 2010A, 2010B, 2010C, 2010F, 2010G, 2010H, 2011B, 2011C, 2011E, 2011J, 2011K, 2011L, 2012A, 2012 B, 2012G, 2012H, 2012I, 2012J, 2012L, 2012M, 2013A, 2013B, 2013D, 2013F, 2013G, 2013H, 2013I, 2014B, 2014C, 2014D, 2014F, 2014I, 2015A, 2015B, 2015C, 2015D, 2015F, 2015G, 2015J
AWI	2013S3, 2013S4, 2014S13, 2014S14, 2014S15, 2014S25, 2015S16, 2015S20, 2015S21, 2015S22, 2015S23, 2015S26, 2015S27, 2015S28, 2015S29, 2015S30, 2015S32, 2015S33, 2015S35, 2016S36, 2016S44, 2016S45, 2016S46, 2016S50, 2017S43, 2017S51, 2017S52, 2017S53

Table S2: Correlation of means snow depth in April among reanalysis-based products

Correlation	SnowModel-LG	NESOISM	UW	CPOM
SnowModel-LG	-	0.83	0.53	0.40
NESOSIM	-	-	0.78	0.69
UW	-	-	-	0.73
CPOM	-	-	-	-

Table S3: R^2(in bold), RMSE (left in bracket, units: cm) and normalized RMSE (right in bracket) in comparison with four OIB products using the snow product's native spatio-temporal resolution

OIB Product	SnowModel-LG	NESOSIM	CPOM	UW	DuST	DESS	PMW Bremen	PMW DMI
Quicklook	**0.19** (11.2,0.23)	**0.28** (9.6,0.23)	**0.42** (7.3,0.15)	**0.03** (3.3,0.15)	**0.25** (5.5,0.14)	**0.34** (15.1,0.41)	**0.51** (5.1,0.11)	**0.53** (4.3,0.10)
GSFC	**0.21** (11.2,0.23)	**0.41** (8.6,0.22)	**0.30** (8.6,0.19)	**0.22** (3.5,0.14)	**0.21** (6.2,0.14)	**0.41** (14.8,0.34)	**0.54** (5.1,0.12)	**0.38** (5.3,0.13)
JPL	**0.33** (10.4,0.15)	**0.41** (8.6,0.15)	**0.55** (7.0,0.13)	**0.29** (3.4,0.10)	**0.26** (6.1,0.13)	**0.46** (14.2,0.35)	**0.61** (4.8,0.10)	**0.52** (4.7,0.08)
SRLD	**0.35** (10.4,0.10)	**0.42** (8.6,0.10)	**0.52** (7.1,0.10)	**0.19** (3.6,0.06)	**0.15** (6.5,0.11)	**0.50** (13.7,0.23)	**0.56** (5.1,0.08)	**0.37** (5.3,0.06)



(a) (b)

Figure S1: The common regions (yellow) of snow product inter-comparison with (a) and without (b) DuST. Also shown the regions of interest in this study: Canadian Arctic (CA), Atlantic (Atlantic) and Pacific & Central Arctic (Pacific)

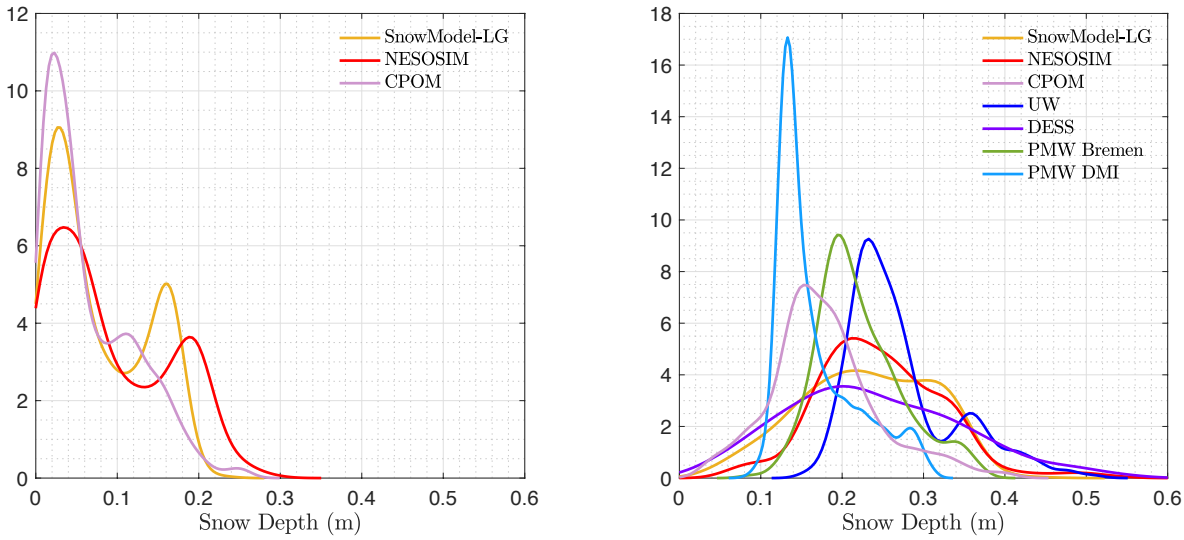


Figure S2: Same as Figure 3, but without DuST and using the common spatial coverage up to 87.5°N

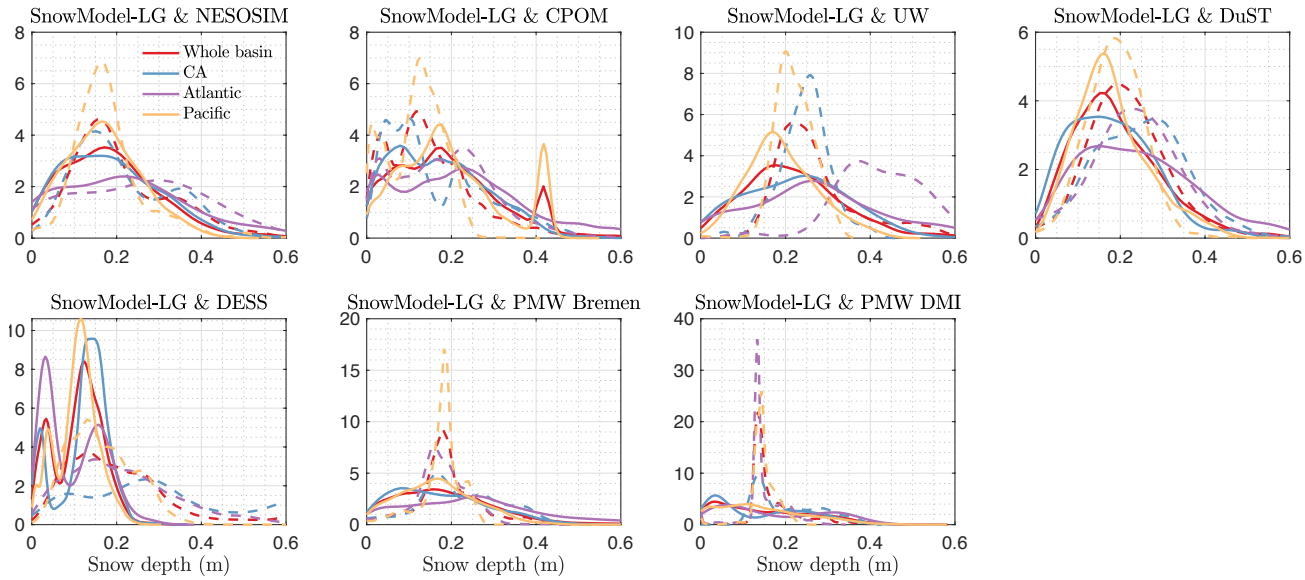


Figure S3: Comparison in distribution of snow depth in spring (March-April) 2015 (units: m) over different regions. Solid lines are from MERRA2-based SnowModel-LG while dashed lines are from corresponding product. The analysis is made based on the common spatial coverage of the different products and SnowModel-LG.

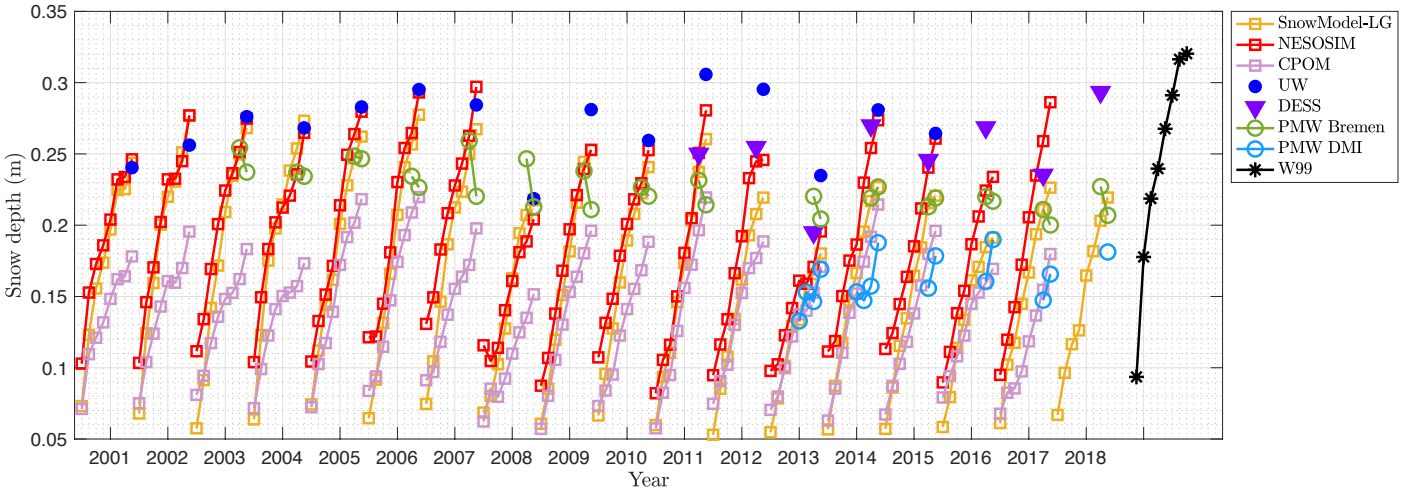


Figure S4: Same with Figure 4 but without DuST and the common coverage is up to 87.5°N

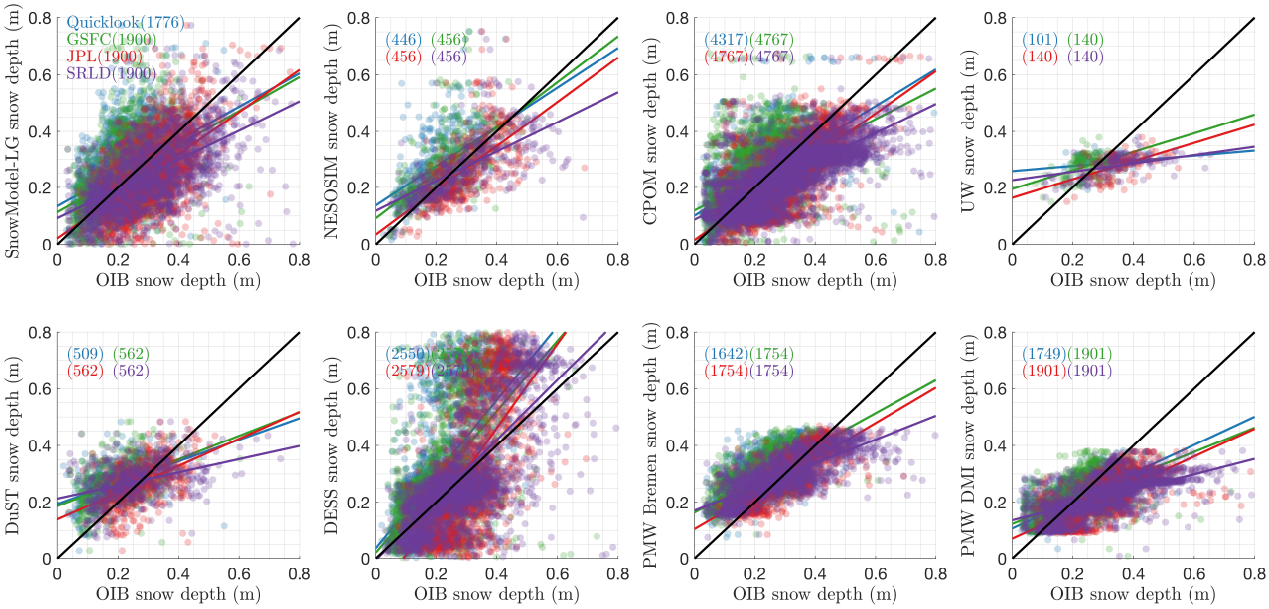


Figure S5: Same as Figure 6, but comparisons with four OIB products using the native spatio-temporal resolution of the snow products

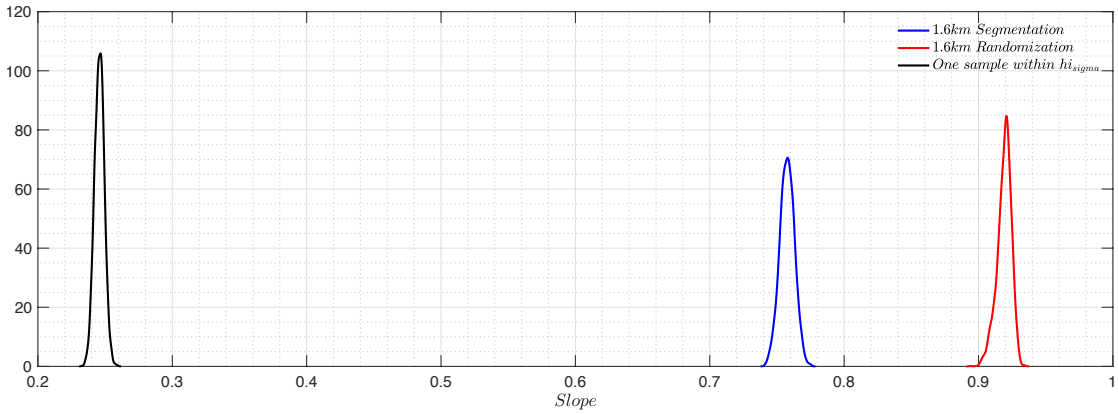


Figure S6: Overall distribution of slopes in three re-sampling strategies, fitting between all OIB samples and 40 random OIB samples (strategy I: red), between all OIB samples and 40 consecutive samples (strategy II: blue) and between all OIB samples and single sample within 1 sigma of the mode of the ice thickness (strategy III: black).