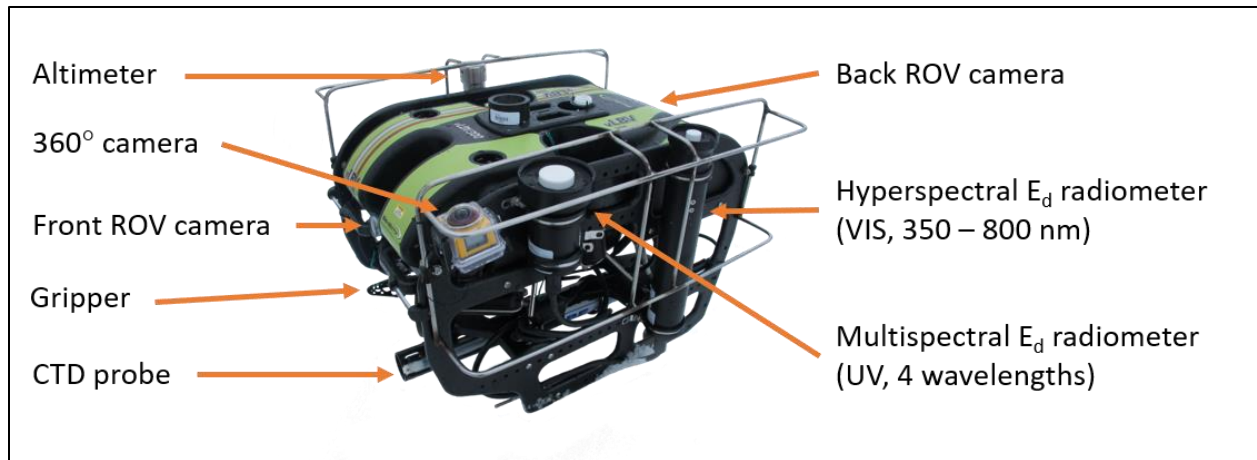
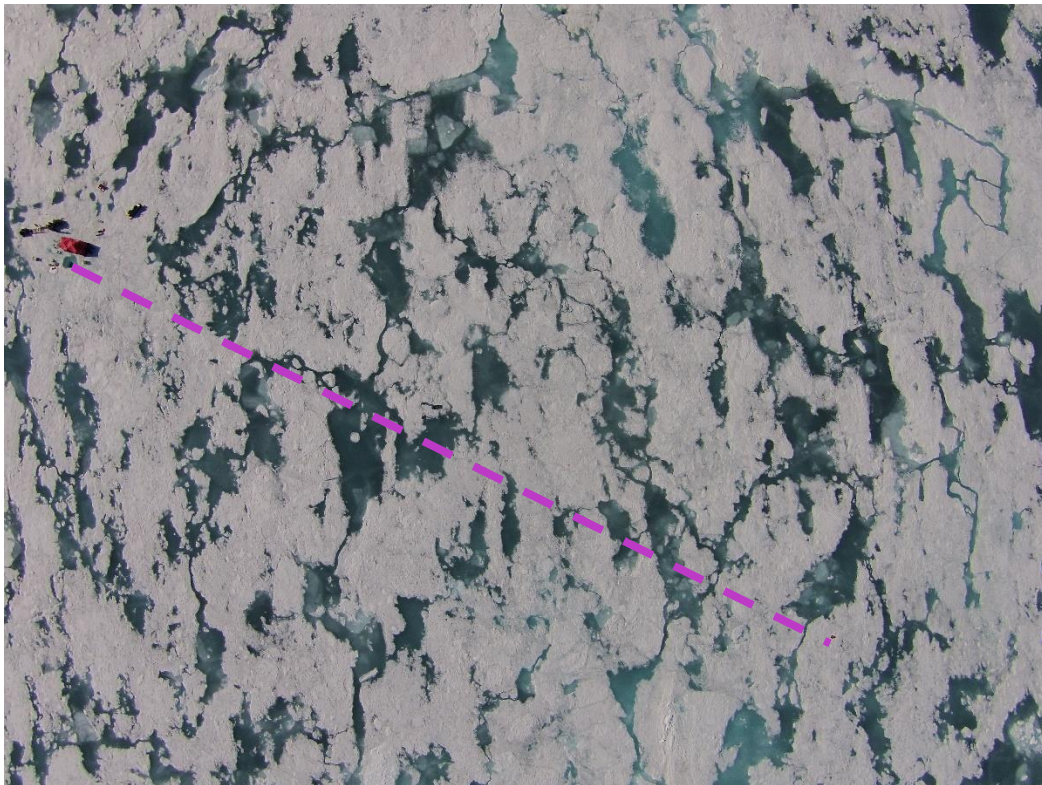


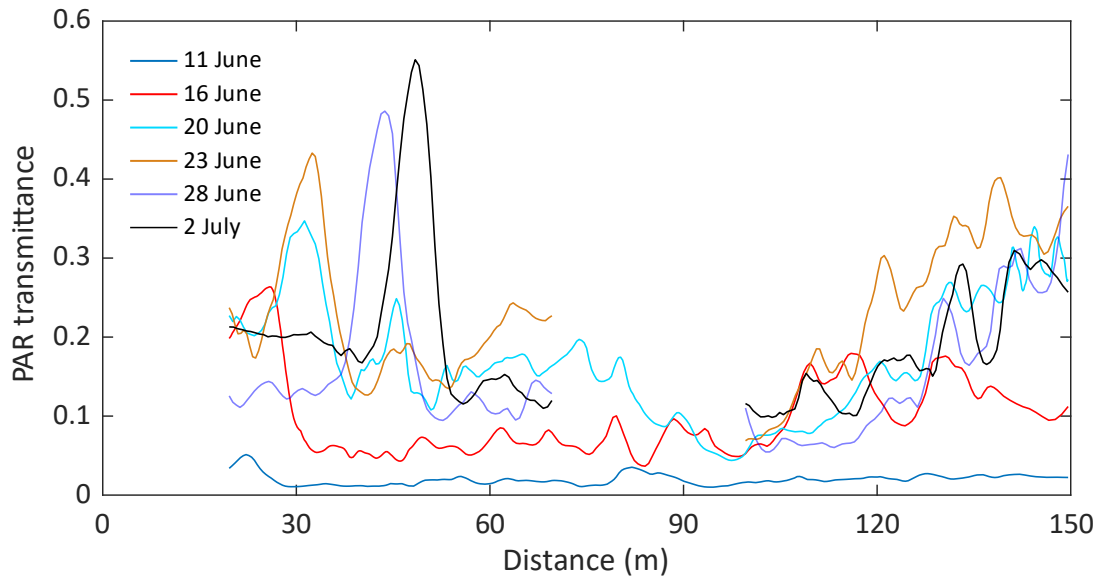
## *Supplemental Material*



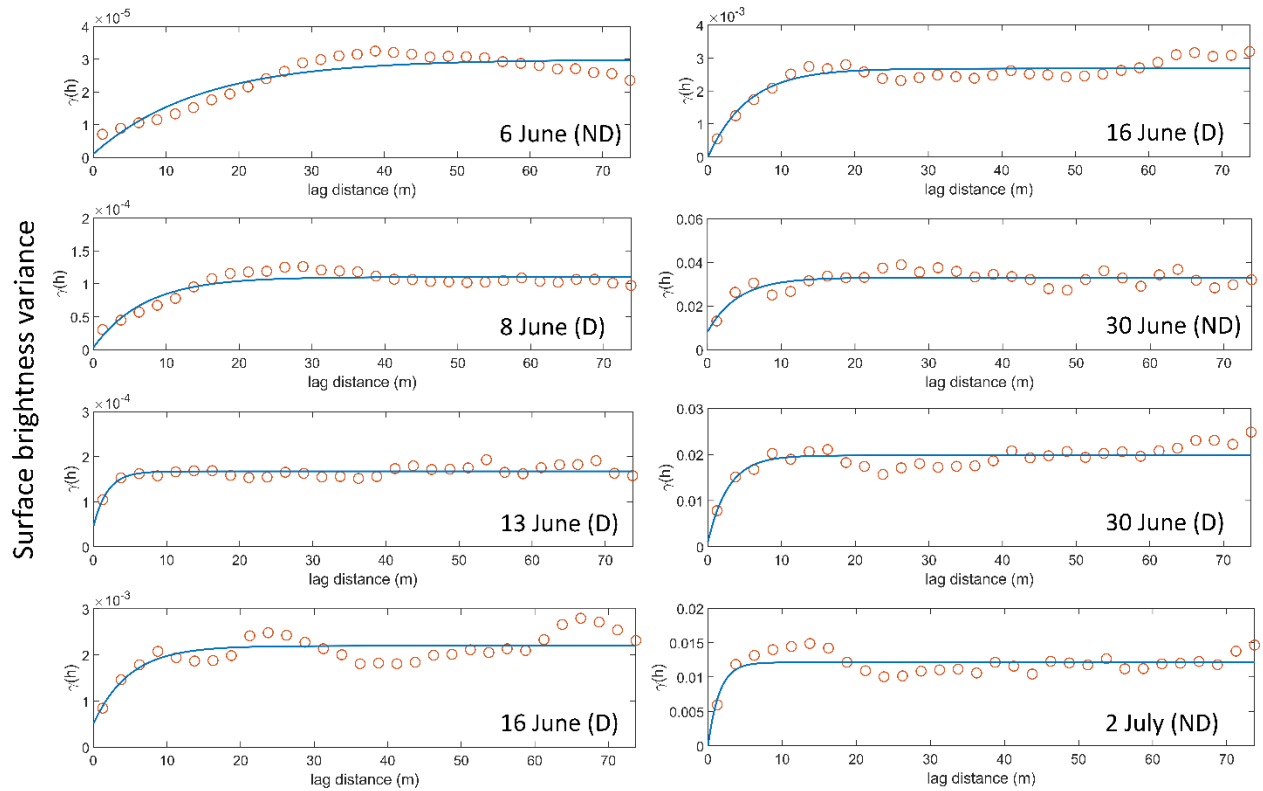
**Supplementary Figure S1.** Photograph of ROV equipped with sensors, cameras and a gripper for under-ice measurements.



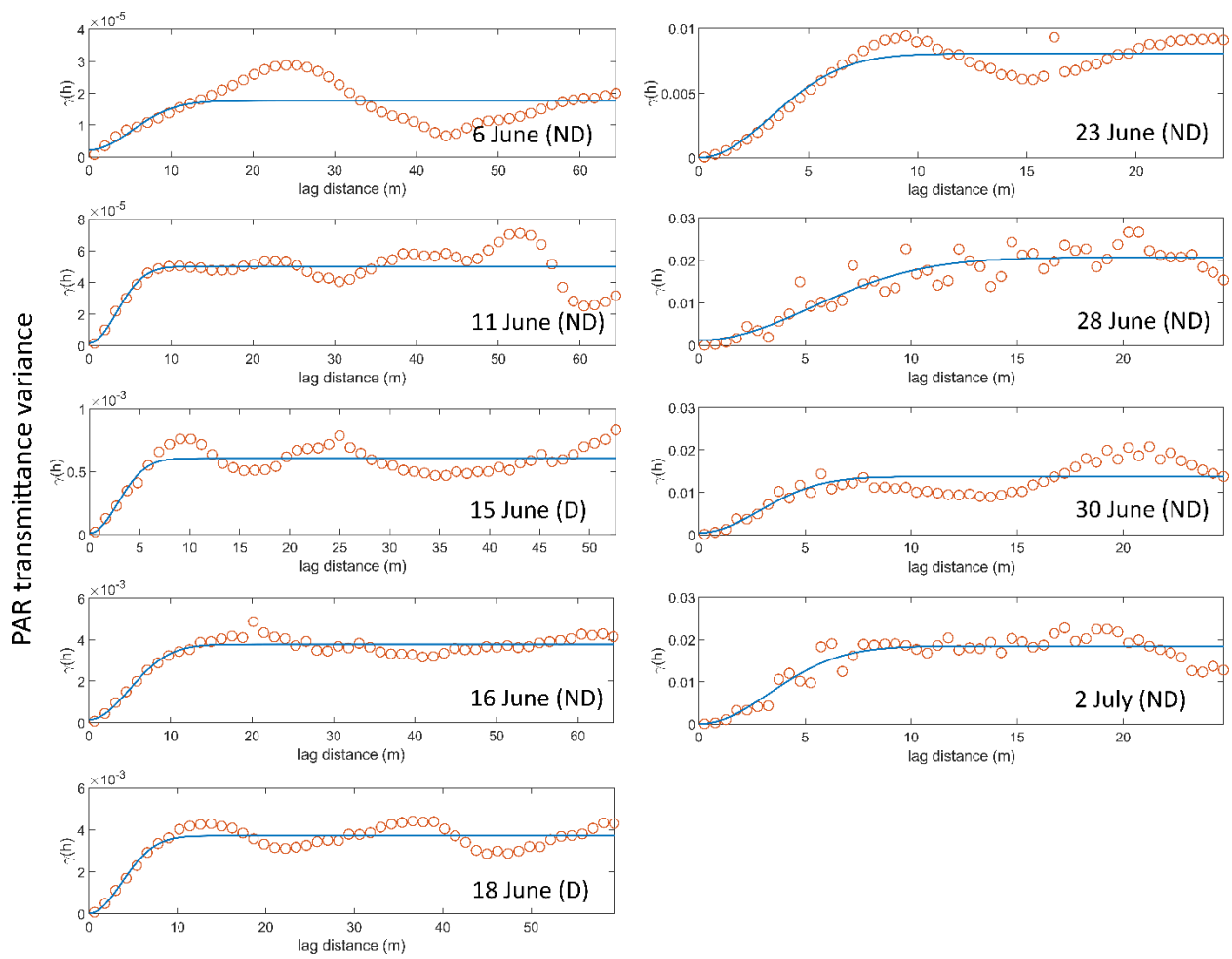
**Supplementary Figure S2.** Areal drone image of sampling area taken at 90 m height on 30 June 2016. The surveyed D transect is shown as orange line.



**Supplementary Figure S3.** PAR transmittance calculated along the ND transect for five days over the sampling period.



**Supplementary Figure S4.** Variograms of surface brightness obtained from horizontal transects. Empirical variograms are shown as orange dots and fitted theoretical exponential variograms are shown as black lines.



**Supplementary Figure S5.** Variograms of PAR transmittance obtained from horizontal transects. Empirical variograms are shown as orange dots and fitted theoretical gaussian variograms are shown as black lines.

**Supplementary Table T1.** Computed mean variogram range (m) of surface reflectance and PAR transmittance of the observed melt stages (I - III).

Variogram range (m)		
	Surface brightness	PAR transmittance
Stage I	4.4	6.0
	n = 2	n = 2
Stage II	5.1	5.3
	n = 2	n = 3
Stage III	2.8	5.2
	n = 3	n = 4

**Supplementary Video V1.** Video of ice bottom recorded at 2 m with a 360 degree action camera along horizontal D transect on 13 June.