Table S1: An overview of the SAR polarimetric parameters examined in this study.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Polarimetric parameters  (FP) | Description | Equation | | Units |
| Span  HH, HV, VV  VV/HH  HV/HH  HV\*HH, VV\*HH  (CP) | Total power  Sigma naught (σ0) backscatter intensity  Co-polarization ratio  Cross-polarization ratio  Polarization multiplications | ***S*** = | | Power  Power  Power  Power    Power |
|  | | |
| S0, S1, S2, S3  RV, RH RR, RL  m  RR/RL  RV/RH  μ | Stokes vectors derived from the covariance matrix C  Sigma naught (σ0) backscatter intensity  Degree of polarization  Circular polarization ratio  Right co-polarized ratio  Conformity coefficient | m =  μ = | | Power  Power  Unitless  Power    Power  Unitless |
|  | Alpha scattering angle | = | | Radians |
| mχd | *mχ* decomposition even bounce component |  | | Power |
| mχv  mχs | *mχ* decomposition volumetric component  *mχ* decomposition odd bounce component |  | | Power  Power |
|  |  |  | |  |

A collage of different types of ice

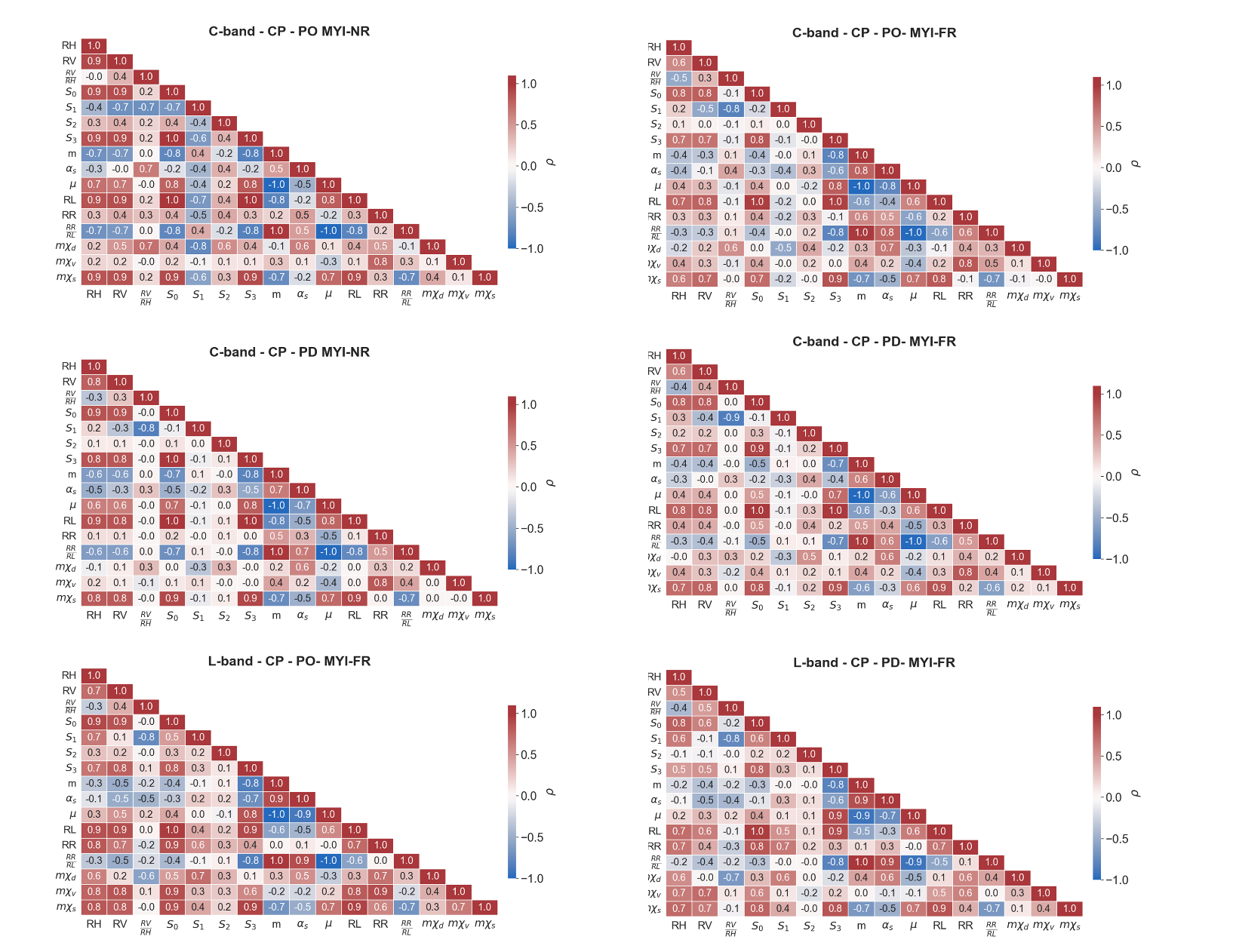
Description automatically generated

Figure S1: Moderate Resolution Imaging Spectroradiometer (MODIS) corrected reflectance, true color timeseries of the advanced melt sub-stage evolution, for 2018 over M’Clintock Channel. The seasonal stages shown are Pond Onset (PO), Pond Evolution (PE) and Pond Drainage (PD).

Chart, timeline

Description automatically generated

Figure S2: Spearman’s correlation matrices for the MYI FP mode. The heatmaps represent the correlation matrices from pond onset (PO) and pond drainage (PD) substages for each polarimetric parameter at C- and L-band. The effect of incidence angle is examined for the near and far range (NR, FR).

Figure S3: Spearman’s correlation matrices for the MYI CP mode. The heatmaps represent the correlation matrices from pond onset (PO) and pond drainage (PD) substages for each polarimetric parameter at C- and L-band. The effect of incidence angle is examined for the near and far range (NR, FR).