

Table S1: Channel Characteristic Parameters of FY-3A/B MWHS-I

Channel Number	Center Frequency (GHz)	Polarization	Bandwidth (MHz)	NE Δ T (K)
1	89	QH	1500	1
2	118.75 $\pm$ 0.08	QV	20	3.6
3	118.75 $\pm$ 0.2	QV	100	2
4	118.75 $\pm$ 0.3	QV	165	1.6
5	118.75 $\pm$ 0.8	QV	200	1.6

Table S2: Channel Characteristic Parameters of FY-3C/D MWHS-II

Channel Number	Center Frequency (GHz)	Polarization	Bandwidth (MHz)	NE Δ T (K)	Calibration Accuracy (K)	3dB Beamwidth
1	89	QH	1500	1	1.3	2.0°
2	118.75±0.08	QV	20	3.6	2	2.0°
3	118.75±0.2	QV	100	2	2	2.0°
4	118.75±0.3	QV	165	1.6	2	2.0°
5	118.75±0.8	QV	200	1.6	2	2.0°
6	118.75±1.1	QV	200	1.6	2	2.0°
7	118.75±2.5	QV	200	1.6	2	2.0°
8	118.75±3.0	QV	1000	1	2	2.0°
9	118.75±5.0	QV	2000	1	2	2.0°
10	150	QH	1500	1	1.3	1.1°
11	183.31±1	QV	500	1	1.3	1.1°
12	183.31±1.8	QV	700	1	1.3	1.1°
13	183.31±3	QV	1000	1	1.3	1.1°
14	183.31±4.5	QV	2000	1	1.3	1.1°
15	183.31±7	QV	2000	1	1.3	1.1°

Table S3: Channel Characteristic Parameters of FY-3E/F MWHS-II

Channel Number	Center Frequency (GHz)	Polarization	Bandwidth (MHz)	NE Δ T (K)	Calibration Accuracy (K)	3dB Beamwidth
1	89	QH	1500	0.4	1	2.0°
2	118.75±0.08	QV	20	2.2	2.4	2.0°
3	118.75±0.2	QV	100	1	1.2	2.0°
4	118.75±0.3	QV	165	0.8	1.2	2.0°
5	118.75±0.8	QV	200	0.8	1.2	2.0°
6	118.75±1.1	QV	200	0.8	1	2.0°
7	118.75±2.5	QV	200	0.8	1	2.0°
8	118.75±3.0	QV	1000	0.5	1	2.0°
9	118.75±5.0	QV	2000	0.5	1	2.0°
10	166	QH	1500	0.4	1	1.1°
11	183.31±1	QV	500	0.6	1	1.1°
12	183.31±1.8	QV	700	0.6	1	1.1°
13	183.31±3	QV	1000	0.5	1	1.1°
14	183.31±4.5	QV	2000	0.5	1	1.1°
15	183.31±7	QV	2000	0.5	1	1.1°

Table S4: Data Time Spans for Each Satellite

Satellite	Instrument	Time Span
FY-3A	MWHS-I	2009-01-01-2013-12-31
FY-3B	MWHS-I	2010-11-18-2019-12-24
FY-3C	MWHS-II	2014-01-01-2024-11-27
FY-3D	MWHS-II	2019-01-01- 2024-12-31
FY-3E	MWHS-II	2023-01-01- 2024-12-31
FY-3F	MWHS-II	2024-01-11- 2024-12-31

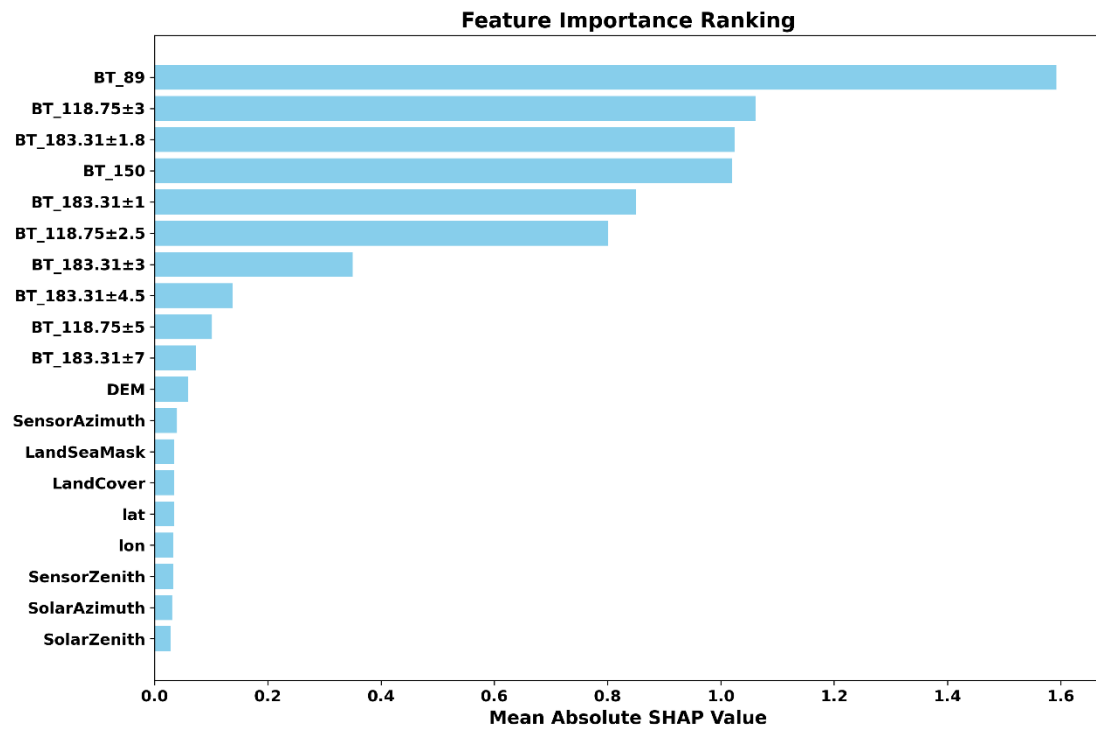


Figure S1: Global feature importance based on SHAP values.

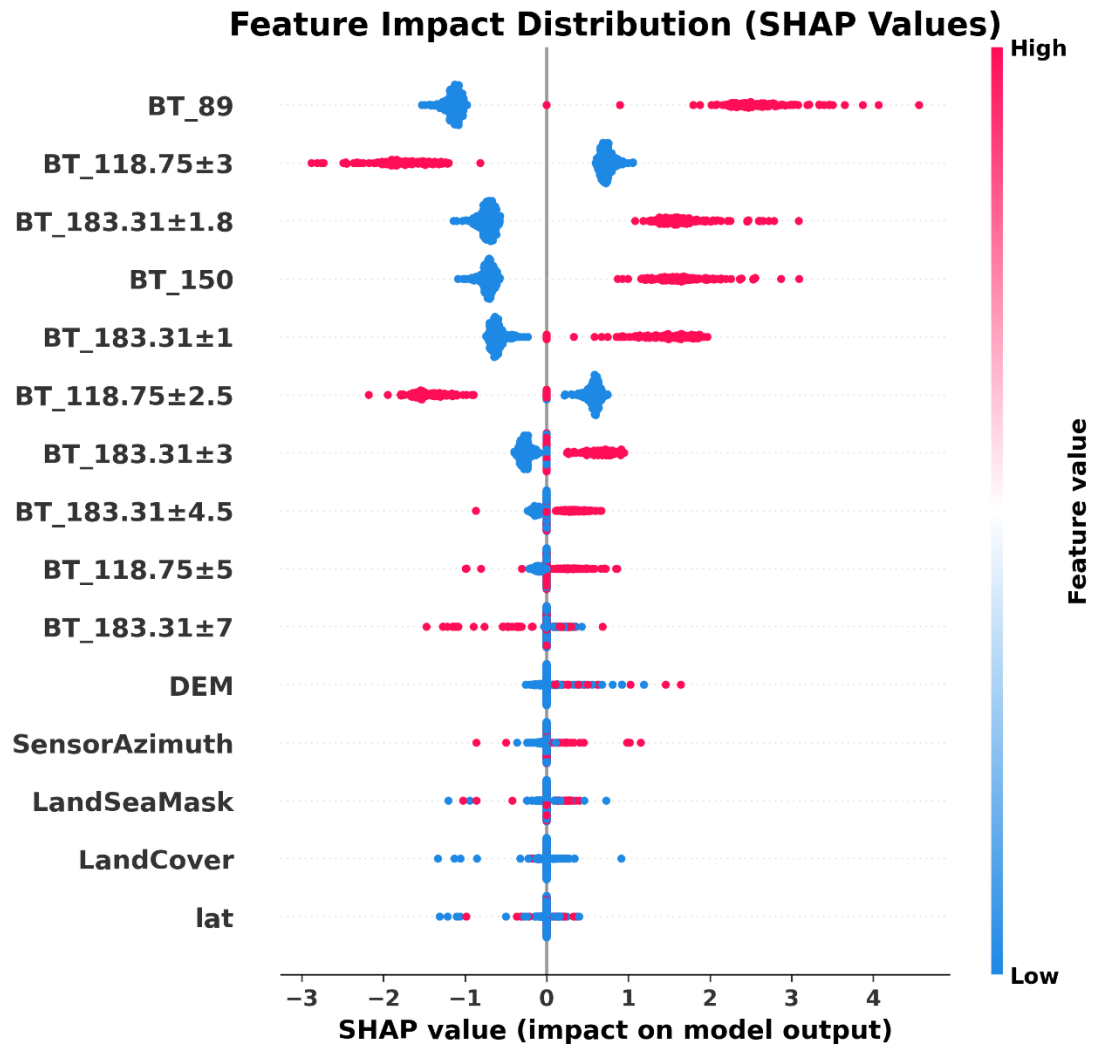


Figure S2: Distribution of feature impact based on SHAP values.

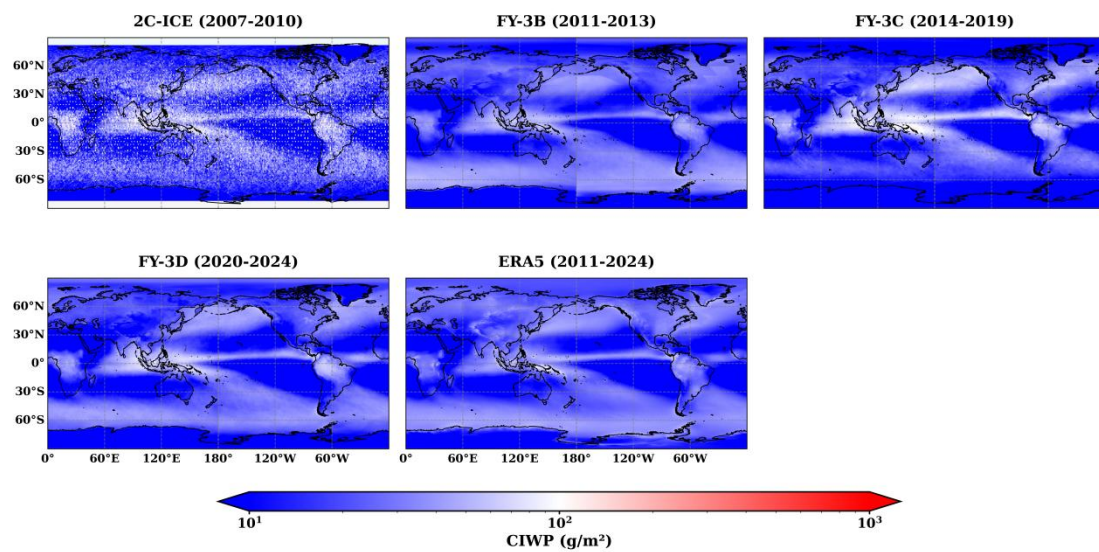


Figure S3: Analogous to Fig. 5 but for CIWP.

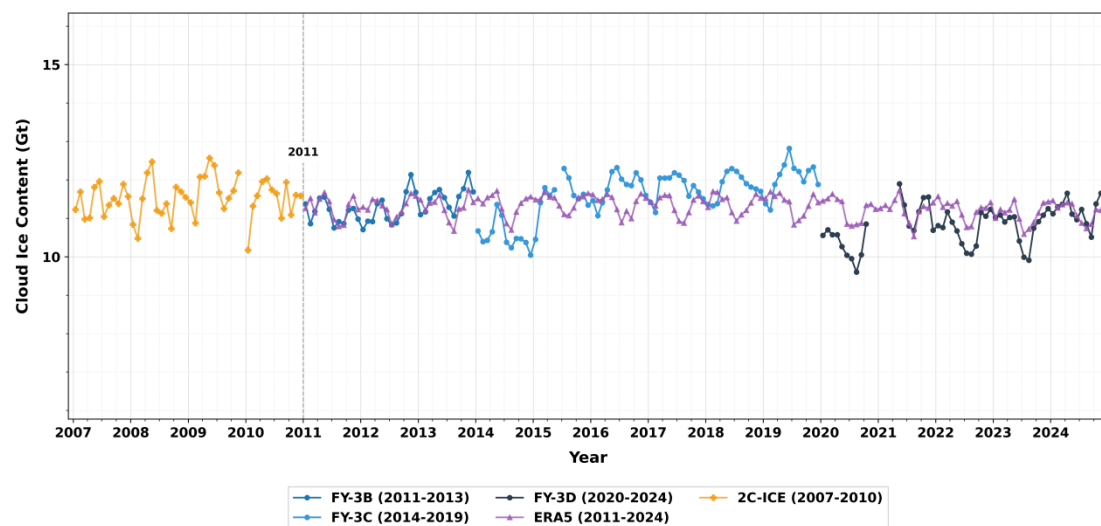


Figure S4: Analogous to Fig. 7 but for Cloud Ice Content. Notably, anomalously elevated CIWP retrievals from FY-3D satellite data during 2020 were excluded from the analysis.