



**Table S1.** Total cloud amount across the different observation times and different datasets in summer over NW region (unit: %). M\_mean is the mean cloud amount averaged over all datasets at each specific observation time, M\_range is the TCA range for all satellite datasets; T\_mean is the mean cloud amount averaged over all observation times for each satellite dataset, T\_range is the TCA range among different observation times. Bold value with an underscore is the mean value averaged over 11 satellite datasets at all observation times, and bold and italic value is for station observation.

	01:30	03:00	07:30	09:00	10:30	13:30	15:00	19:30	21:00	22:30	T_mean	T_range
ISCCP-D1		53.5		64.8			75.6		60.7		63.7	22.1
PATMOSX	56.1		66.6			50.7		52.5			56.5	15.9
MODIS-CE	41.7				40.9	50.8				46.8	45	9.9
MODIS-ST	45.9				40.2	46.1				44.7	44.2	5.8
HIRS	32.2		30.9			35.1		33.2			32.9	4.2
TOVSB	60.2		56.2			57.4		62.2			59	6
AIRS-LMD	52.8					43.8					48.3	9
CALIPSO-GOCCP	53.5					66.5					60	13.1
CALIPSO-ST	58.3					67					62.7	8.8
POLDER						45.5					45.5	0
MISR					37.6						37.6	0
M_mean	50.1	53.5	51.2	64.8	39.6	51.4	75.6	49.3	60.7	45.7	50.5	8.6
M_range	28	0	35.7	0	3.3	31.9	0	29	0	2.1		
station											52.1	

**Table S2.** Total cloud amount across the different observation times and different datasets in winter over NW region (unit: %). M\_mean is the mean cloud amount averaged over all datasets at each specific observation time, M\_range is the TCA range for all satellite datasets; T\_mean is the mean cloud amount averaged over all observation times for each satellite dataset, T\_range is the TCA range among different observation times. Bold value with an underscore is the mean value averaged over 11 satellite datasets at all observation times, and bold and italic value is for station observation.

	01:30	03:00	07:30	09:00	10:30	13:30	15:00	19:30	21:00	22:30	T_mean	T_range
ISCCP-D1		42.8		47.9			55.1		44.5		47.6	12.3
PATMOSX	53.9		71.5			34.6		38.3			49.6	36.9
MODIS-CE	29.5				24.5	32.9				33.1	30	8.5
MODIS-ST	47				73.4	73.2				47.6	60.3	26.3
HIRS	52		53.9			36.1		48.3			47.6	17.8
TOVSB	54.7		68			69.3		47.9			60	21.4
AIRS-LMD	39.3					41.2					40.2	1.9
CALIPSO-GOCCP	40.2					47					43.6	6.8
CALIPSO-ST	52.4					49.3					50.9	3
POLDER						25.5					25.5	0
MISR					28.7						28.7	0
M_mean	46.1	42.8	64.4	47.9	42.2	45.5	55.1	44.8	44.5	40.3	44	12.3
M_range	25.2	0	17.6	0	48.8	47.7	0	10	0	14.5		
station											37.4	



