

1 **Supplementary information**

2

3 **Contrasting patterns of change in snow line altitude across five Himalayan**
4 **catchments**

5 Orié Sasaki¹, Evan S. Miles², Francesca Pellicciotti², Akiko Sakai¹, Koji Fujita¹

6 ¹Graduate School of Environmental Studies, Nagoya University, Nagoya, 484–8601, Japan

7 ²Swiss Federal Institute for Forest, Snow, and Landscape Research WSL, Birmensdorf, CH-8903, Switzerland

8

9 *Correspondence to:* Orié Sasaki (sasaki.o.ab@m.titech.ac.jp)

10

11 **Content:**

12 **1. Supplementary Figures**

- 13 ● **Figure S1: Monthly total precipitation and mean air temperature for the five target regions**
- 14 ● **Figure S2: Schematic diagram of the snowline detection algorithm**
- 15 ● **Figure S3: Comparison of cumulative frequency of SLAs**
- 16 ● **Figure S4: Comparison of detected SLA among three satellites**
- 17 ● **Figure S5: Snowlines derived from automatic and manual detections.**
- 18 ● **Figure S6: Comparison of detected SLAs from this study and standard detection method using**
19 **MODIS**

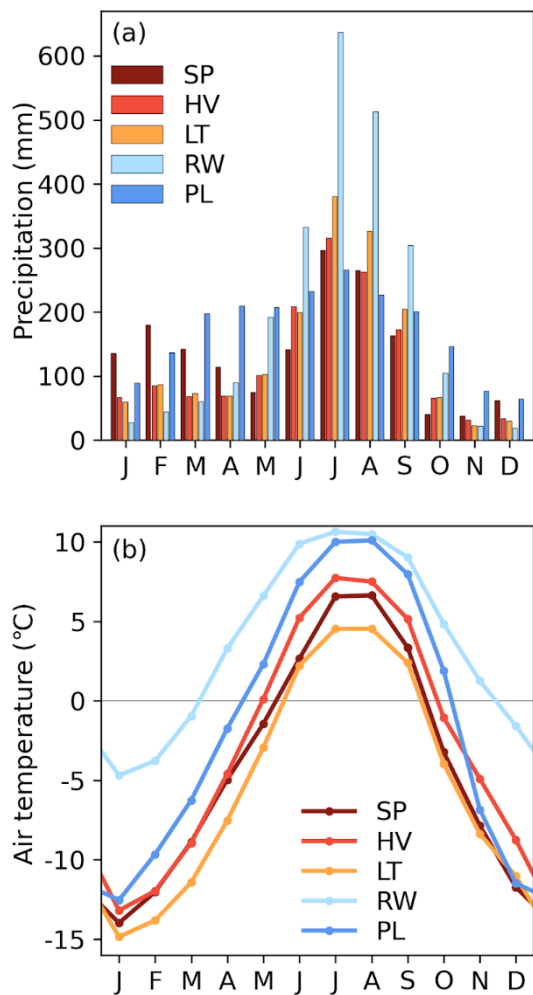
20

21 **2. Supplementary Tables**

- 22 ● **Table S1: Results of the multiple regression analysis for the 60-month moving average**

23

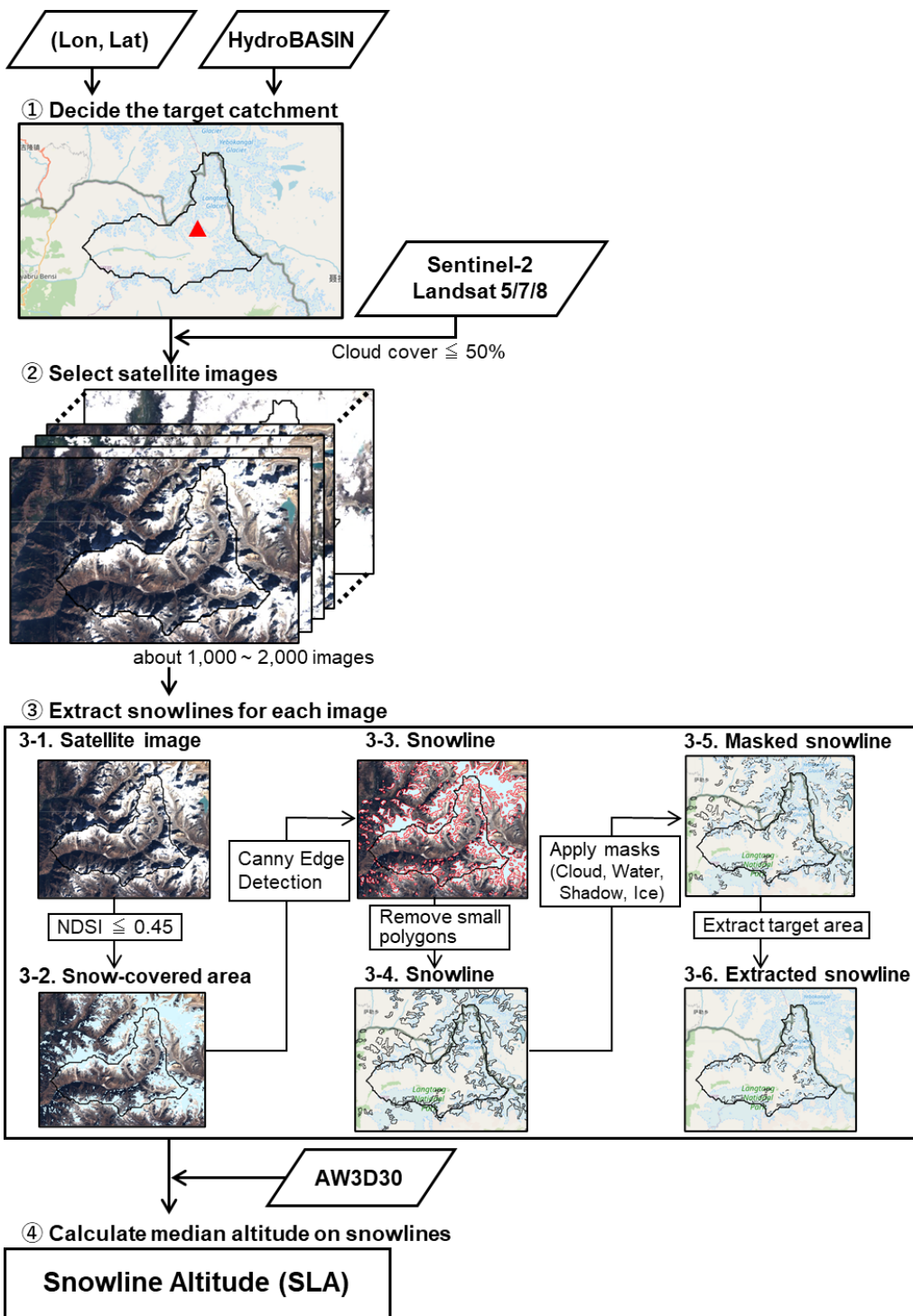
24



25

26 **Figure S1: (a) Monthly total precipitation and (b) mean air temperature obtained from the ERA5 reanalysis climate data (Hersbach**
 27 **et al., 2020). The data were averaged for the period from 1999 to 2019 at the grid that includes most of the target catchment without**
 28 **any corrections. Catchment abbreviations denote SP: Satopanth, HV: Hidden Valley, LT: Langtang Valley, RW: Rolwaling Valley,**
 29 **and PL: Parlung, respectively.**

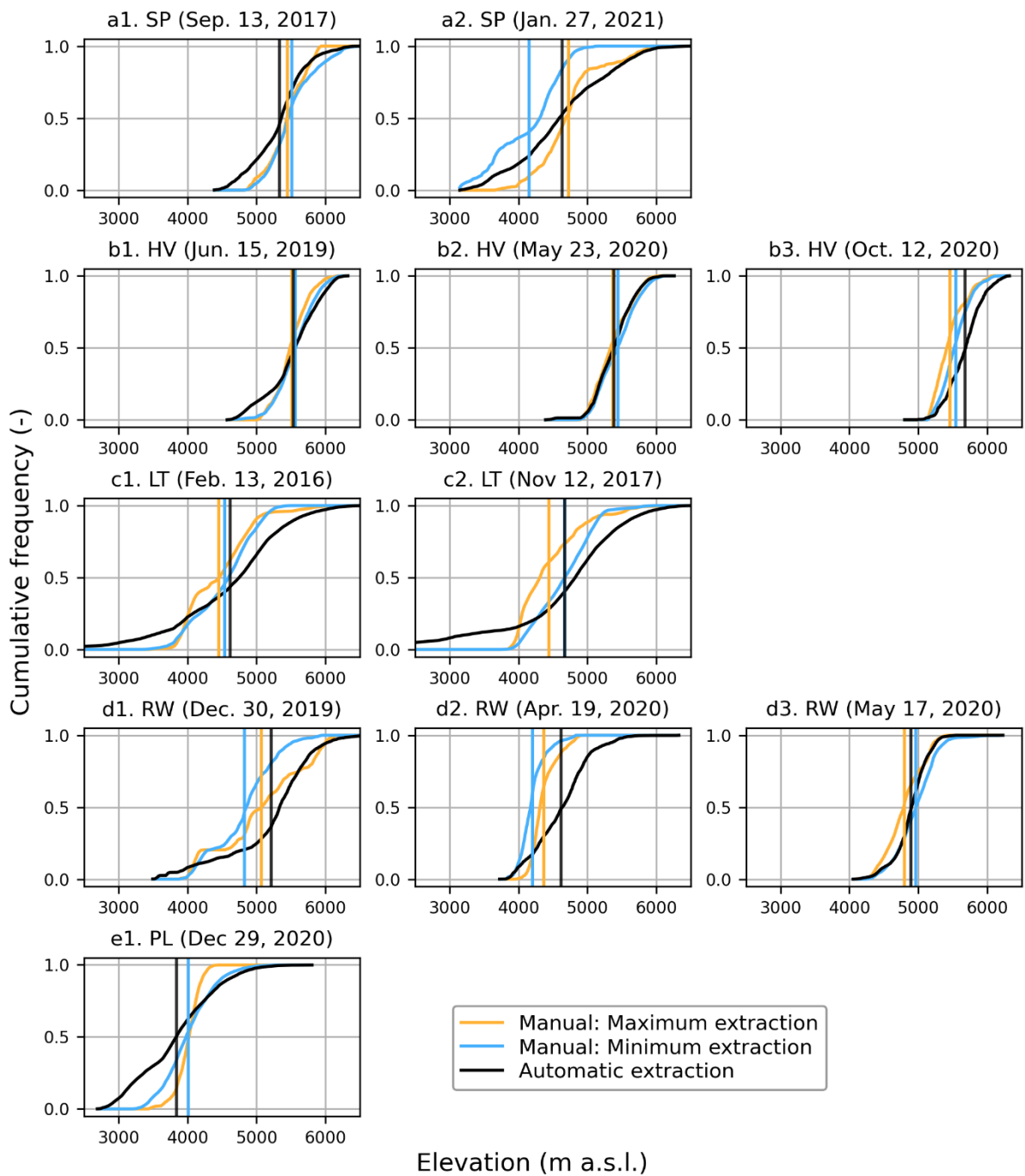
30



31

32 Figure S2: Schematic diagram of the snowline detection algorithm with a sample image obtained from Landsat 8

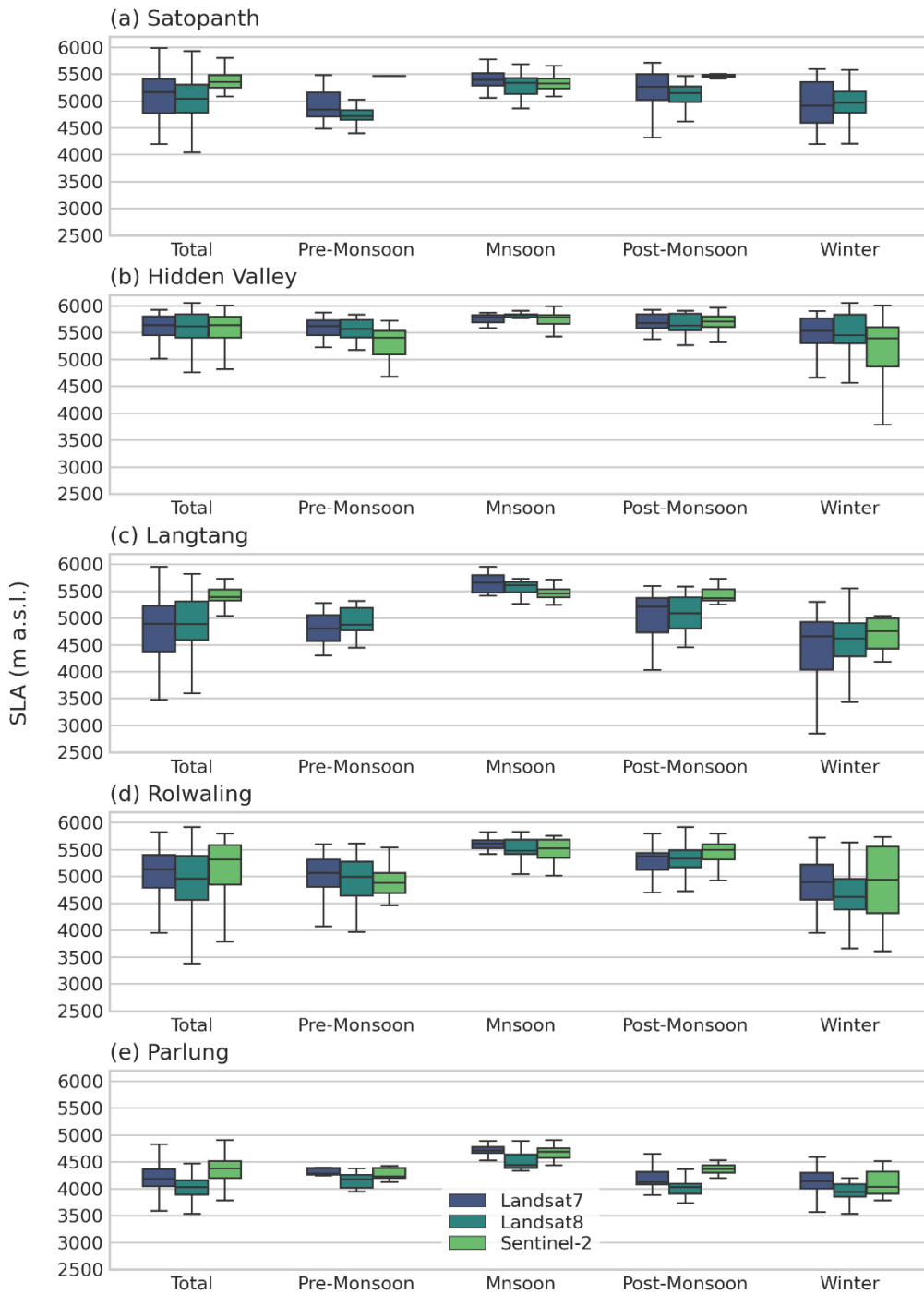
33



34

35 **Figure S3: Comparison of cumulative frequency of SLA between the automatically detected snowlines and the manually delineated**
 36 **ones. a1-2, b1-3, c1-2, d1-4, and e1 show the comparison in Satopanth (SP), Hidden Valley (HV), Langtang (LT), Rolwaling (RW),**
 37 **and Parlung (PL), respectively.**

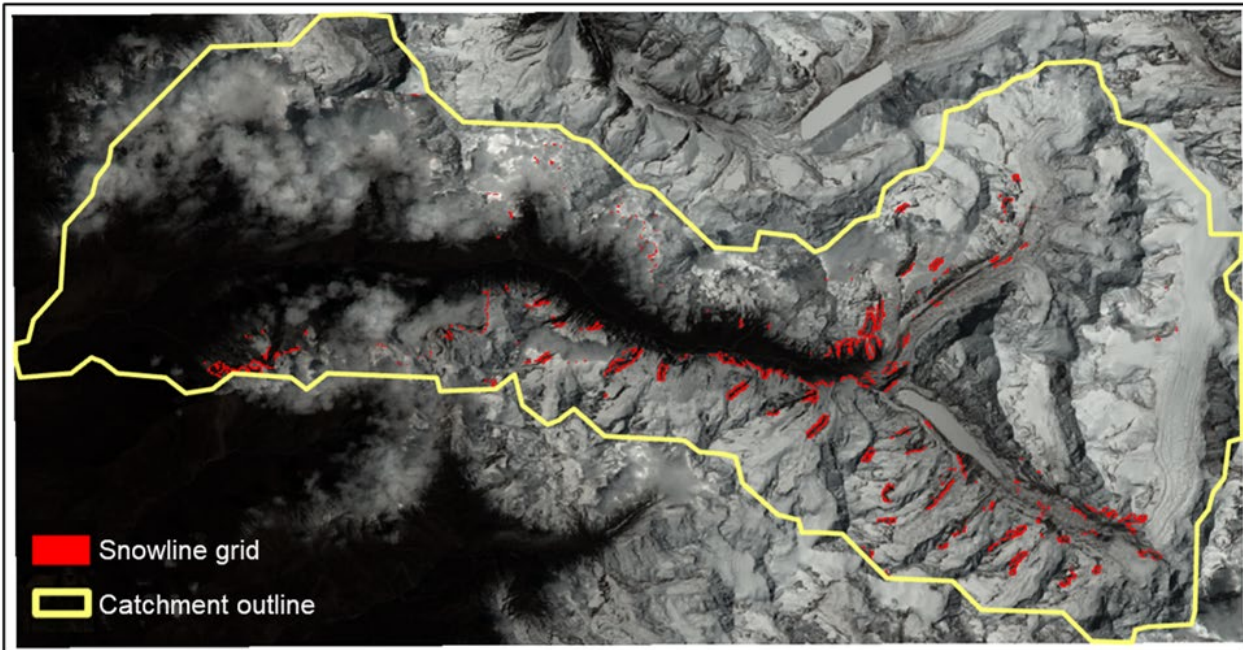
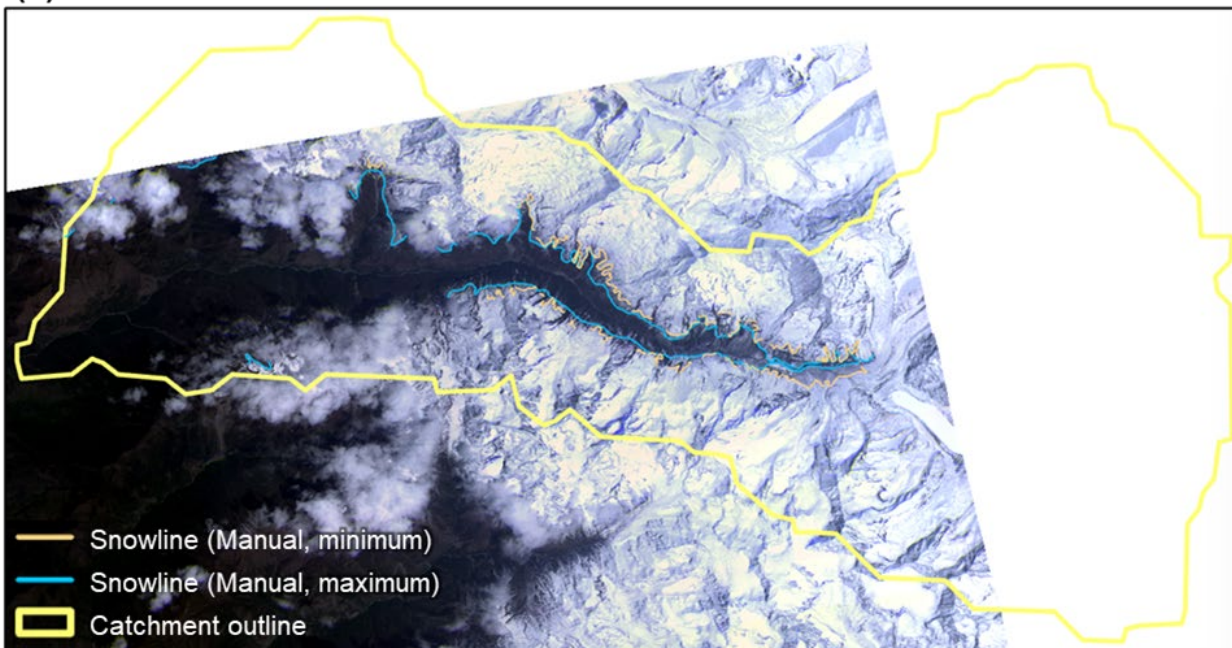
38



39

40 **Figure S4: Comparison of cumulative frequency of SLA between the automatically detected snowlines and the manually delineated**
 41 **ones.**

42

(a) Automatic detection**(b) Manual detection**

44

45 **Figure S5: Snowlines derived from (a) automatic detection and (b) manual detection. The background images are the**
 46 **satellite images used for snowline detection: (a) Landsat 8 on April 20, 2020, and (b) PlanetScope on April 19, 2019.**

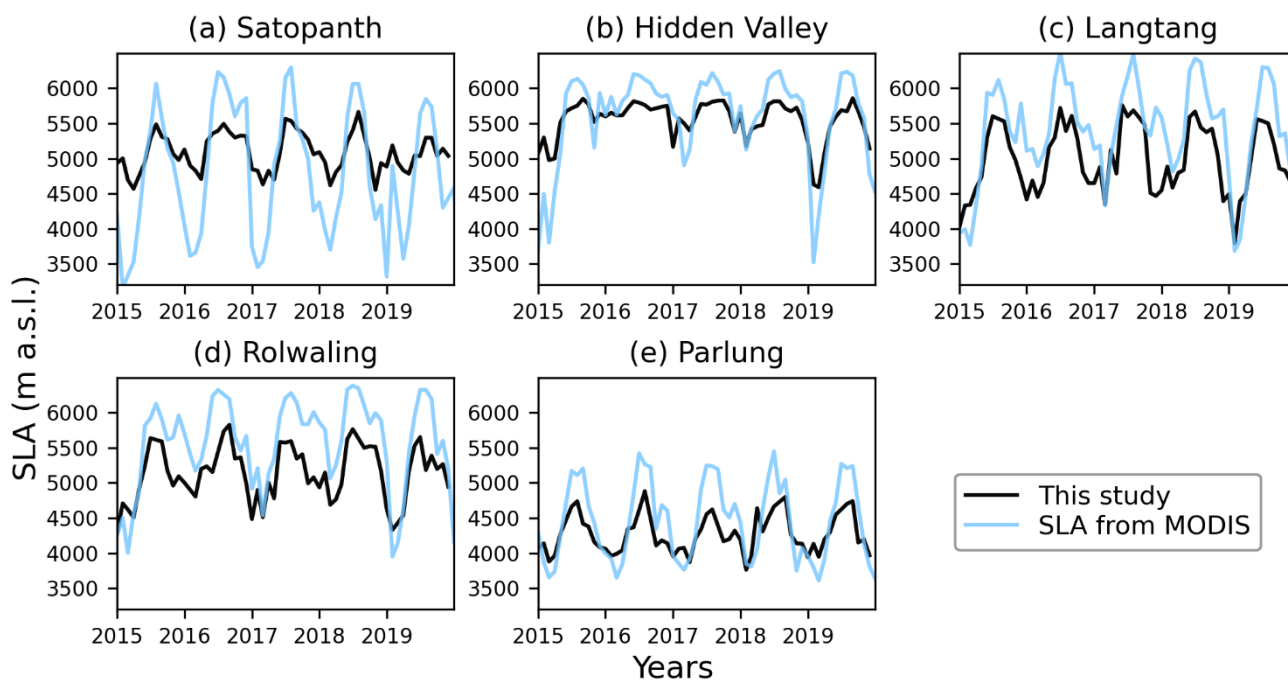
47

48

49

50

51



52

53

Figure S6: Comparison of detected SLAs from this study and standard detection method using MODIS.

54

55

57 **Table S1: Results of the multiple regression analysis using 60-month moving averages of climate data and SLA. Influential factors**
 58 **(p-value < 0.05 and |t-value| > 2.0) are shown in bold. A positive or negative t-value indicates a contribution to the increase or**
 59 **decrease of SLA, respectively.**

		Coefficient	Standard error	t-value	p-value
Satopanth	Air temperature	89.9	10.38	8.66	<0.001
	Precipitation	-1.39	0.47	-2.96	0.003
	Solar radiation	-2.48	1.54	-1.61	0.108
Hidden Valley	Air temperature	114.54	20.39	5.62	<0.001
	Precipitation	8.19	0.99	8.29	<0.001
	Solar radiation	24.83	5.42	4.58	<0.001
Langtang	Air temperature	123.29	16.59	7.43	<0.001
	Precipitation	7.94	0.85	9.37	<0.001
	Solar radiation	2.90	4.92	0.59	0.556
Rolwaling	Air temperature	224.13	6.34	35.35	<0.001
	Precipitation	7.72	0.36	21.59	<0.001
	Solar radiation	28.44	1.31	21.67	<0.001
Parlung	Air temperature	33.23	9.60	3.46	0.001
	Precipitation	-0.03	0.27	-0.12	0.905
	Solar radiation	1.34	0.84	1.29	0.114