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Figure S1. (A) Sentinel 1 median polarization ratio (VV/VH) averaged from October 2018 to April 2021. (B) Sentinel 1 standard deviation polarization ratio (VV/VH) averaged from October 2018 to April 2021. Polarization ratios indicate the amount of depolarization usually associated with scattering on vegetation, especially trees.

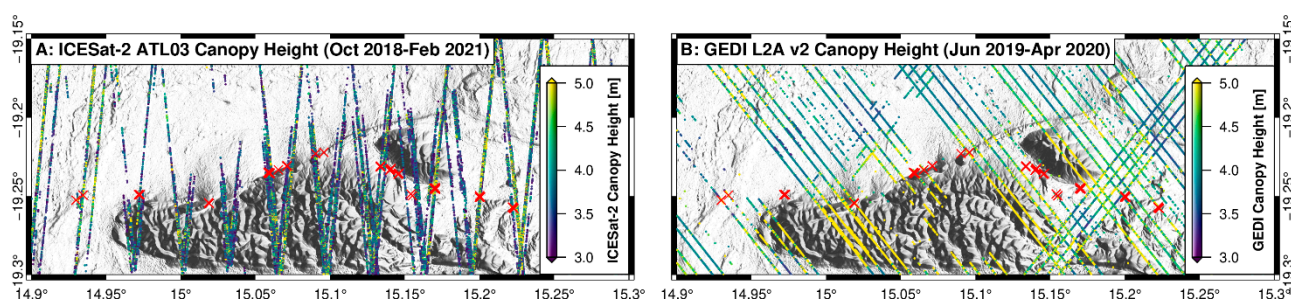
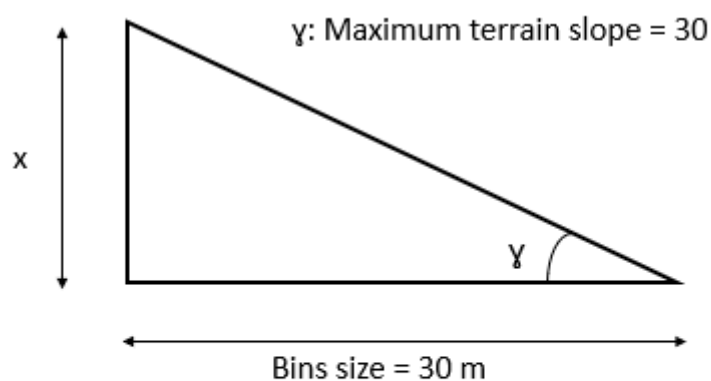


Figure S2. ICESat-2 and GEDI ground tracks for the area where field-based tree measurements were taken. Red crosses indicate the 55 field-based tree height measurements of different species for validation. Red polygon outlines study area including more densely vegetated mountainous terrain and blue polygon is limited to the low-slope, sparsely vegetated savanna ecosystem. (B) Canopy height measurements taken from GEDI product L2A (version 2).



$$x = \text{Bins size} * \tan(\pi/180 * \text{Maximum terrain slope})$$

$$x = 30 * \tan(\pi/180 * 30)$$

Figure S3. Filtering threshold based on the bin sizes and the maximum terrain slope

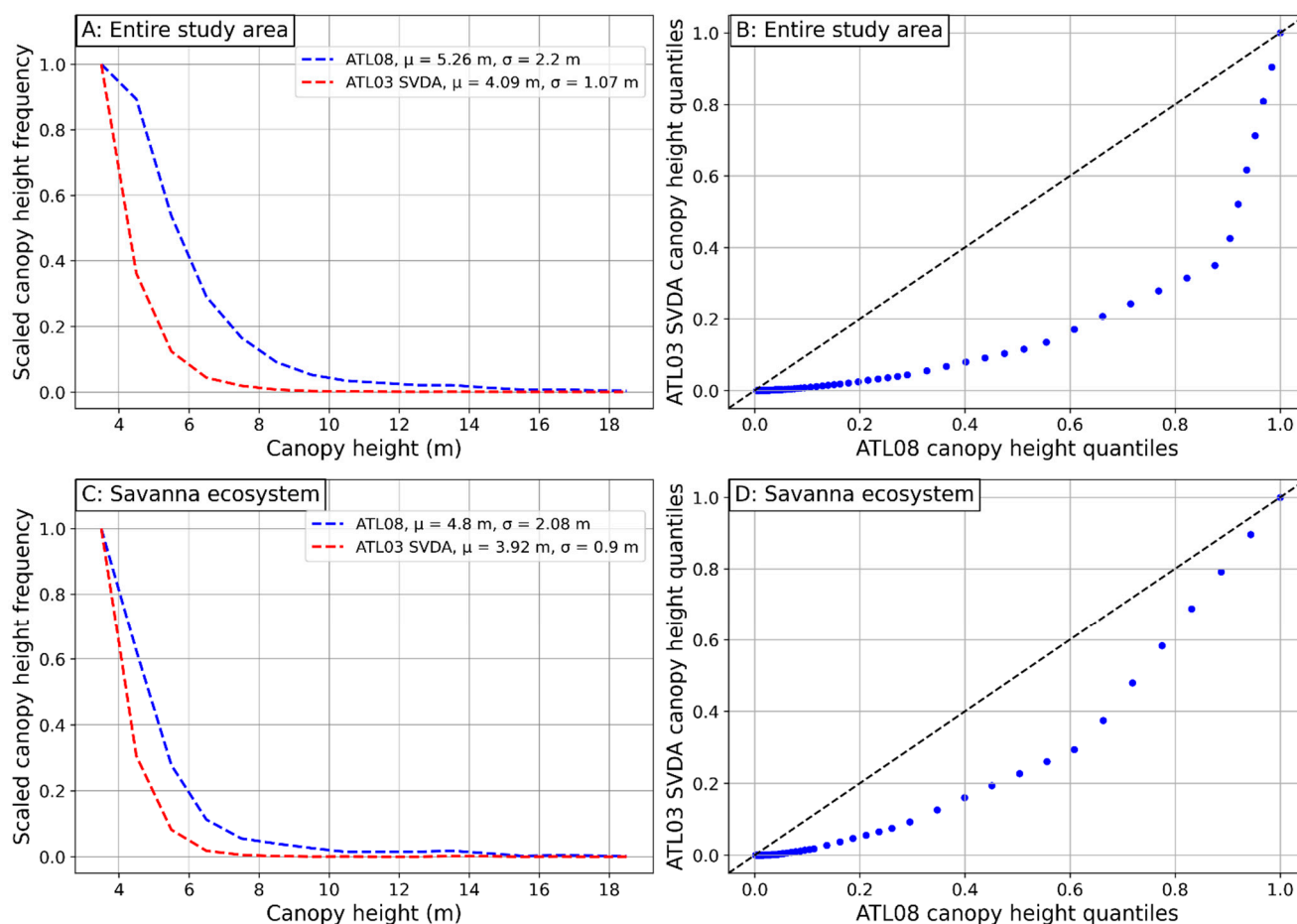


Figure S4. ATL03 SVDA and ATL08 canopy height comparison. (A+C) ATL03 SVDA and ATL08 full canopy height distributions in the study areas shown red and blue polygons in Figure 1B+C and Figure 2 in the main manuscript. (B+D) Quantile-quantile plots of ATL03 SVDA and ATL08 canopy height in the study areas.

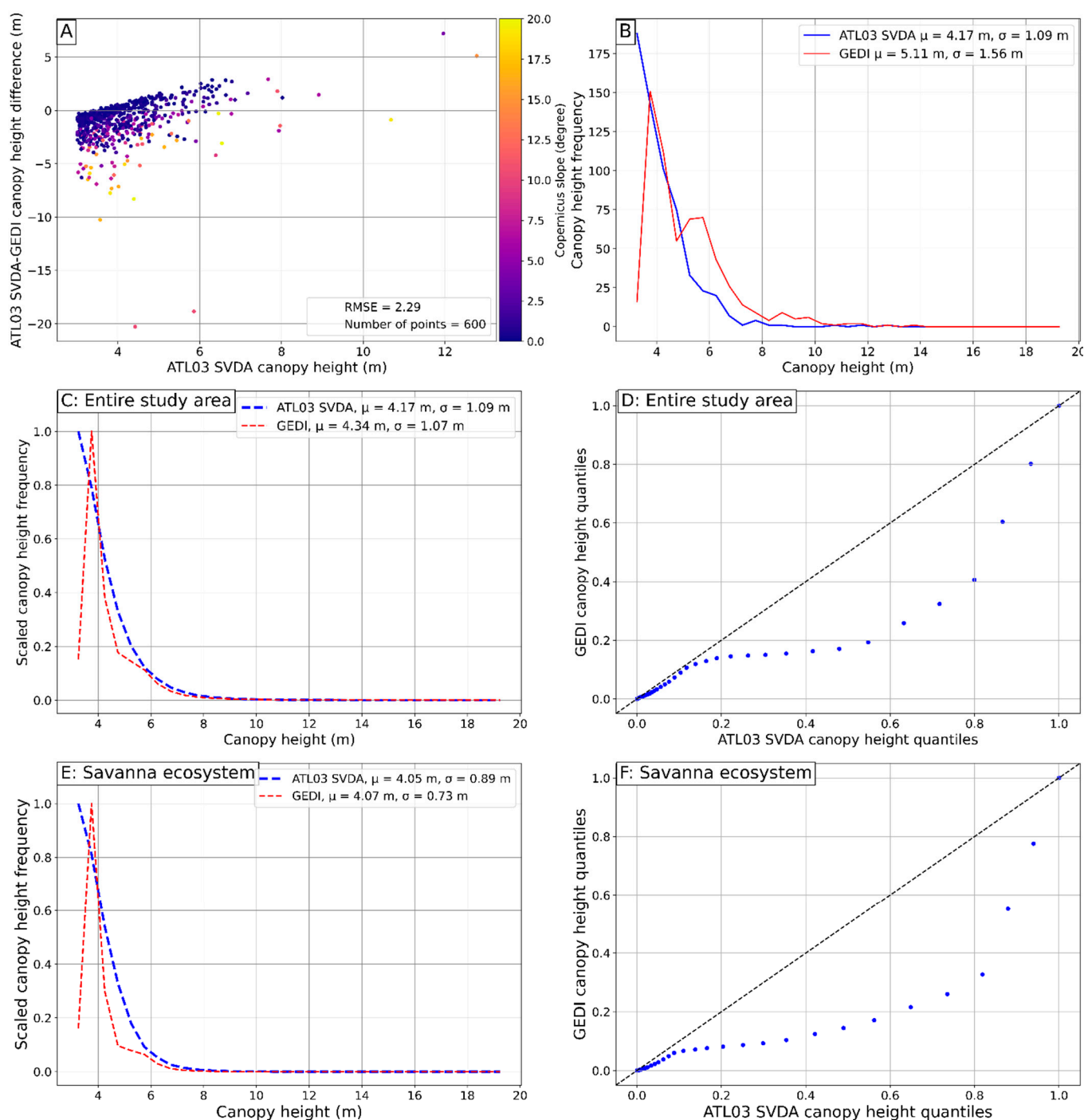


Figure S5. GEDI L2A version 2 and ATL03 SVDA canopy height relationship (A) GEDI L2A version 2 and ATL03 SVDA canopy height difference of the 600 overlapping measurements within a buffer of 5 m. (B) ATL03 SVDA and GEDI L2A distributions of the 600 overlapping measurements within a buffer of 5 m. (C+E) ATL03 SVDA and GEDI L2A full canopy height distributions in the study areas shown red and blue polygons in Figure 1B+C and Figure 2 in the main manuscript. (D+F) Quantile-quantile plots of ATL03 SVDA and GEDI L2A canopy height in the study areas. GEDI L2A canopy heights are generally lower than ATL03 SVDA canopy heights.

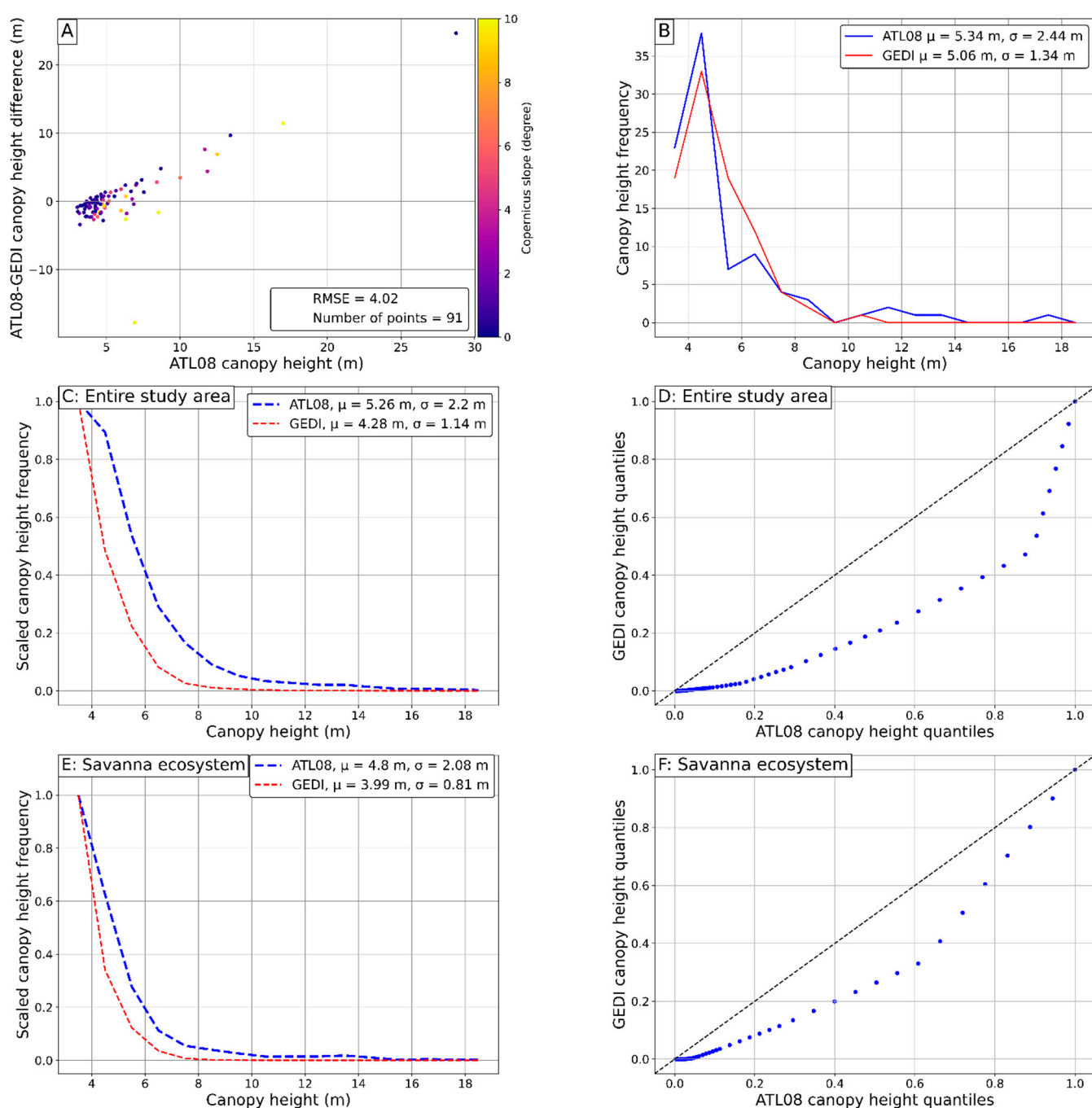


Figure S6. GEDI L2A version 2 and ATL08 canopy height relationship (A) GEDI L2A version 2 and ATL08 canopy height difference of the 91 overlapping measurements within a buffer of 5 m. (B) ATL08 and GEDI L2A distributions of the 91 overlapping measurements within a buffer of 5 m. (C+E) ATL08 and GEDI L2A full canopy height distributions in the study areas shown red and blue polygons in Figure 1B+C and Figure 2 in the main manuscript. (D+F) Quantile-quantile plots of ATL08 and GEDI L2A canopy height in the study areas. GEDI L2A canopy heights are generally lower than ATL08 canopy heights.

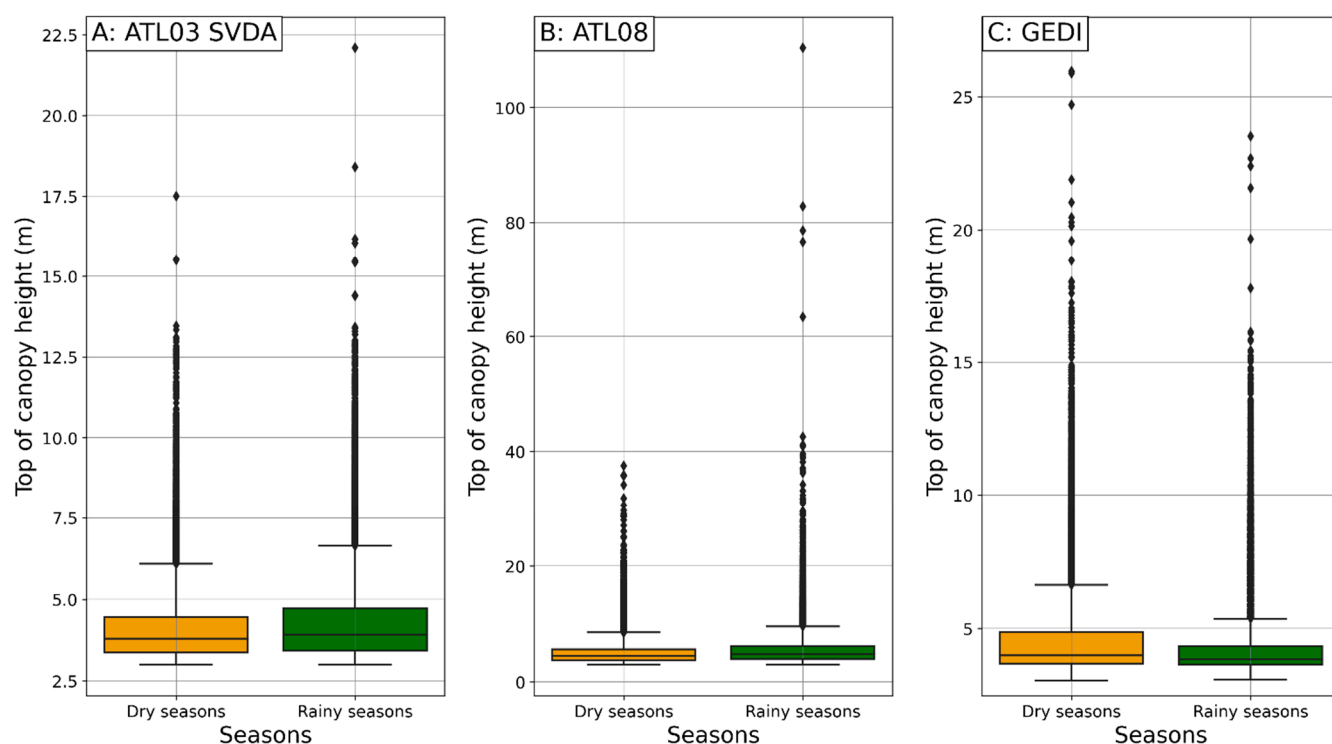


Figure S7. (A) Tree height seasonal changes from ATL03 SVDA. (B) Tree height seasonal changes from ATL08. (C) Tree height seasonal changes from GEDI L2A.

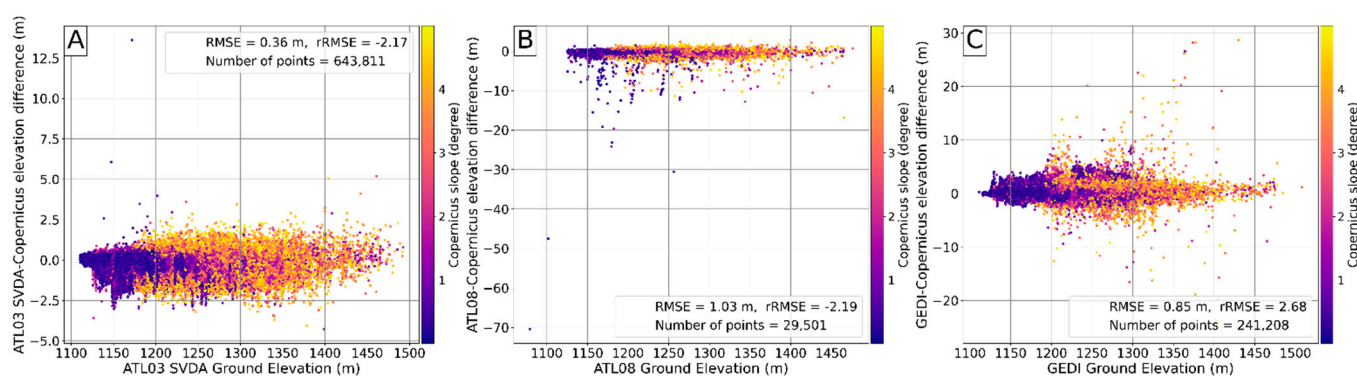


Figure S8. Ground height validation with Copernicus DEM in low terrain slope (terrain slope below 5 degrees). (A): Copernicus DEM elevation and ATL03 SVDA based on ATL03 ground height measurements difference as described in section 3.6.1. (B): Copernicus DEM elevation and ATL08 ground height difference. We note that two ATL08 ground height points resulted in points resulted in a difference more than 40 m compared to the ground elevation from Copernicus. (C): Copernicus DEM elevation and GEDI difference.