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Figures

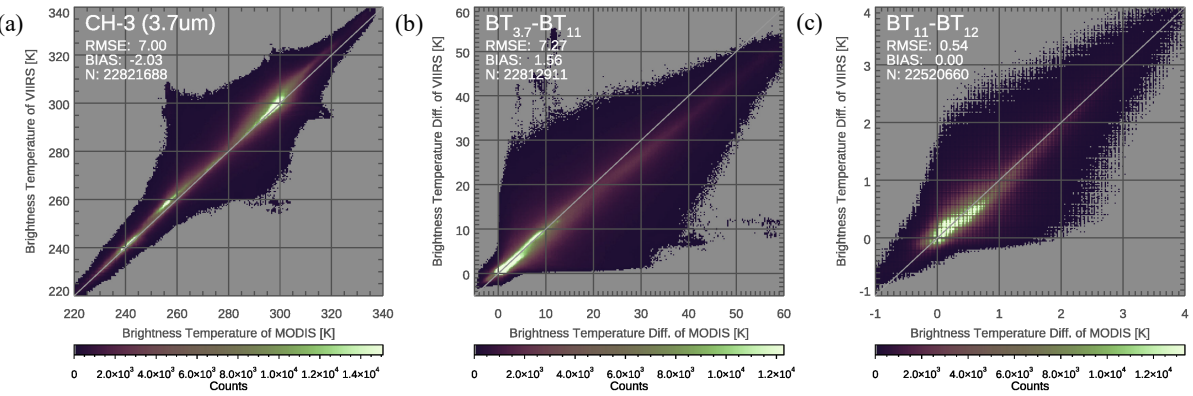
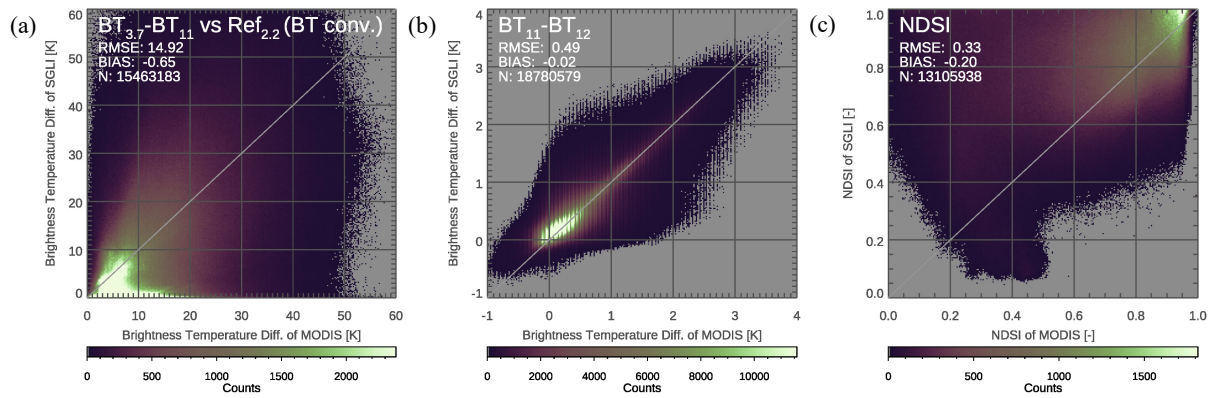


Figure S1: Scatter plots of reference brightness temperature (BT) and brightness temperature difference (BTD) from Aqua/MODIS versus adjusted BT and BTD from VIIRS, shown for (a) $BT_{3.7\mu m}$, (b) $BT_{3.7\mu m} - BT_{11\mu m}$, and (c) $BT_{11\mu m} - BT_{12\mu m}$.

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Figure S2: Scatter plots of reference brightness temperature difference (*BTD*) and normalized difference snow index (*NDSI*) from Terra/MODIS versus adjusted *BTD* and *NDSI* from SGLI, shown for (a) $BT_{3.7\mu m} - BT_{11\mu m}$ for MODIS and *BTD*-equivalent converted from SGLI's $Ref_{2.2\mu m}$, (b) $BT_{11\mu m} - BT_{12\mu m}$, and (c) *NDSI*.

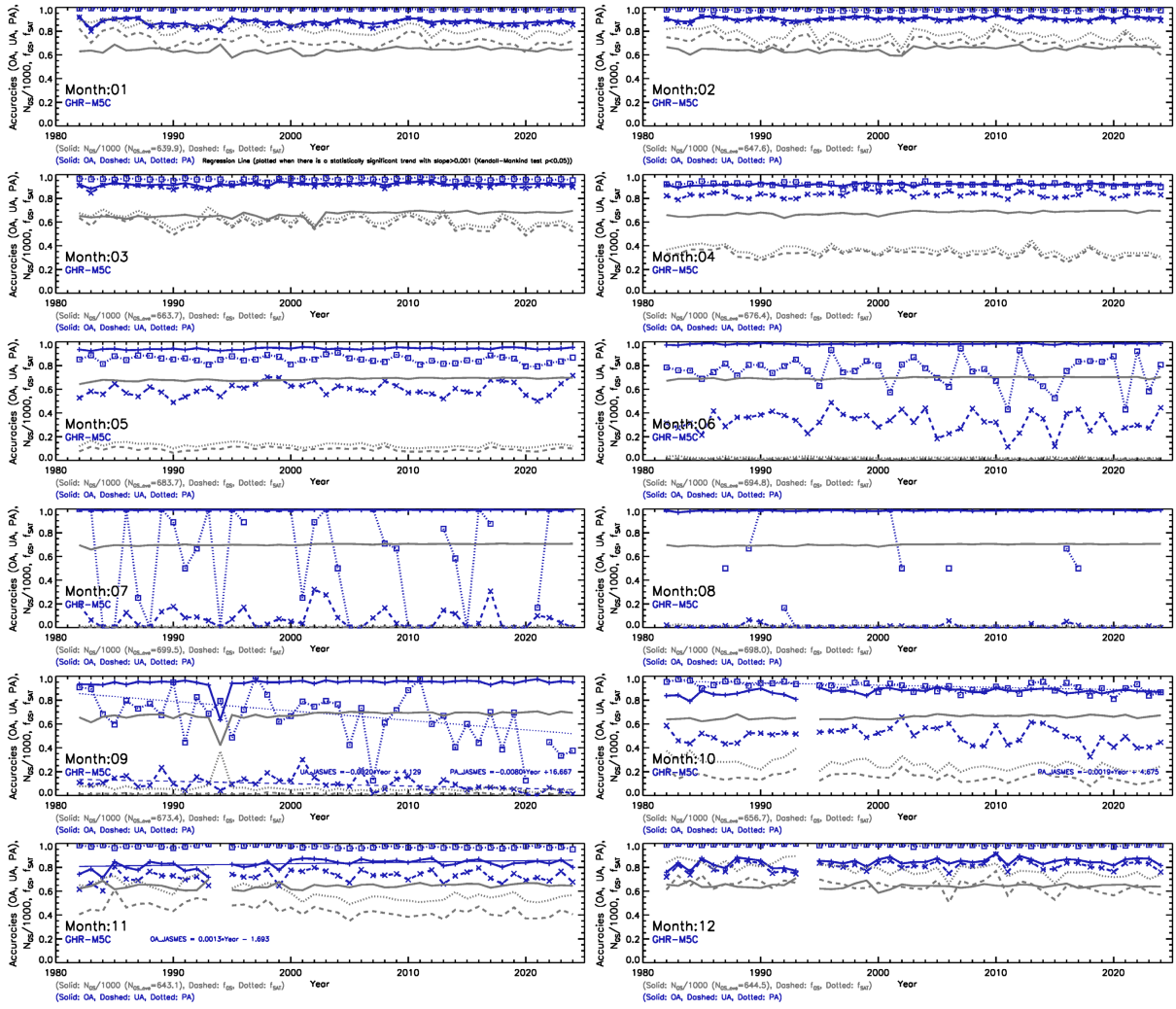


Figure S3: Long-term monthly trends in OA , UA , and PA for GHR-M5C snow cover products for the period from 1982 to 2024. Linear regression lines and equations with the slope and intercept calculated as the Theil-Sen robust line are shown only when the linear trend is statistically significant (Mann-Kendall test $p < 0.05$) and the slope is larger than $0.001 \text{ [year}^{-1}]$. Also shown are time series of the number of ground station (N_{GS}) used for the validation (gray solid line), fraction of ground stations where ground stations themselves detected snow cover (f_{GS}) (gray dashed line), and fraction of ground stations where the satellite detected snow cover (f_{SAT}) (gray dotted line).

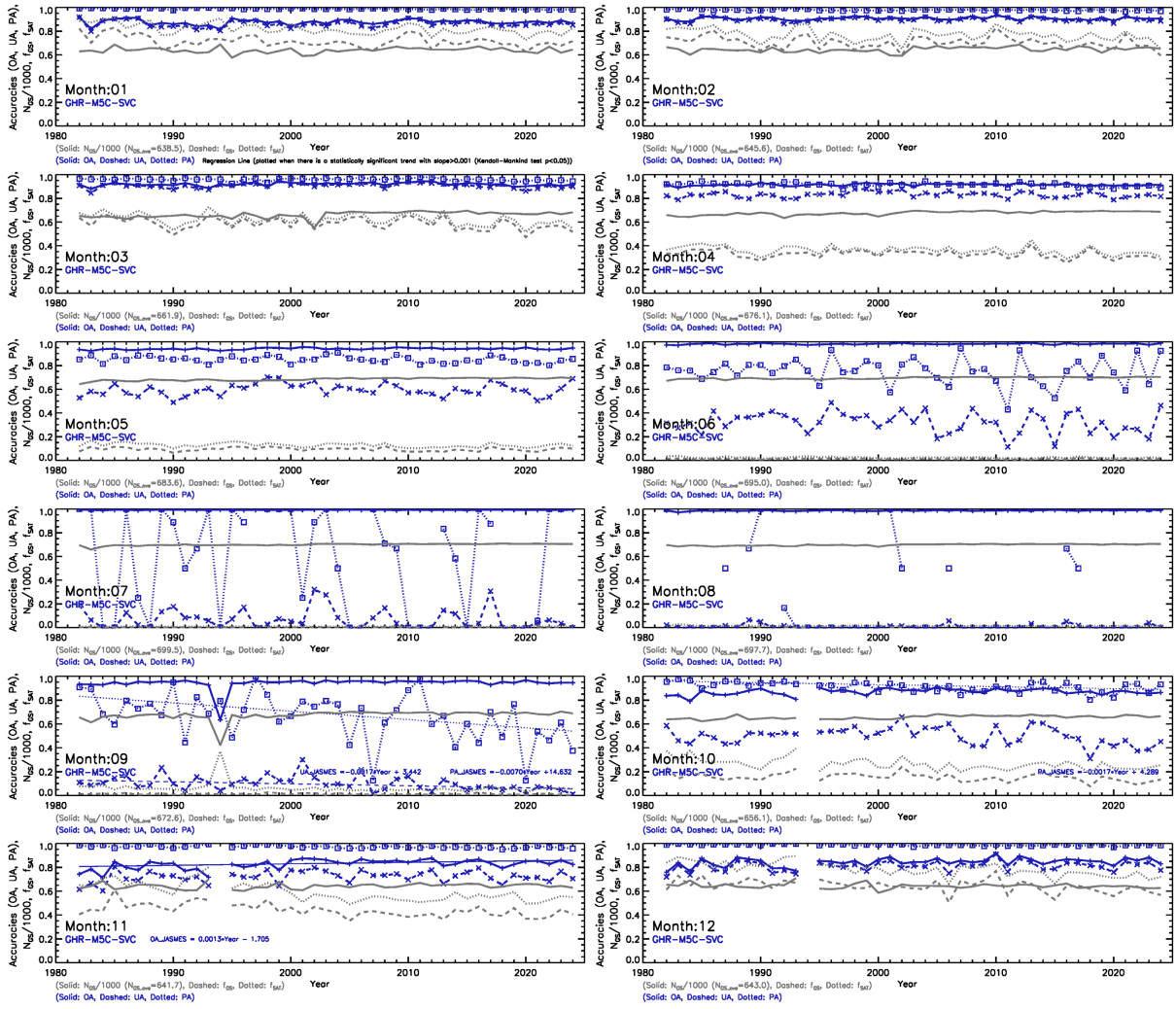


Figure S4: Long-term monthly trends in OA , UA , and PA for GHR-M5C-SVC snow cover products for the period from 1982 to 2024. Linear regression lines and equations with the slope and intercept calculated as the Theil-Sen robust line are shown only when the linear trend is statistically significant (Mann-Kendall test $p < 0.05$) and the slope is larger than $0.001 \text{ [year}^{-1}]$. Also shown are time series of the number of ground station (N_{GS}) used for the validation (gray solid line), fraction of ground stations where ground stations themselves detected snow cover (f_{GS}) (gray dashed line), and fraction of ground stations where the satellite detected snow cover (f_{SAT}) (gray dotted line).

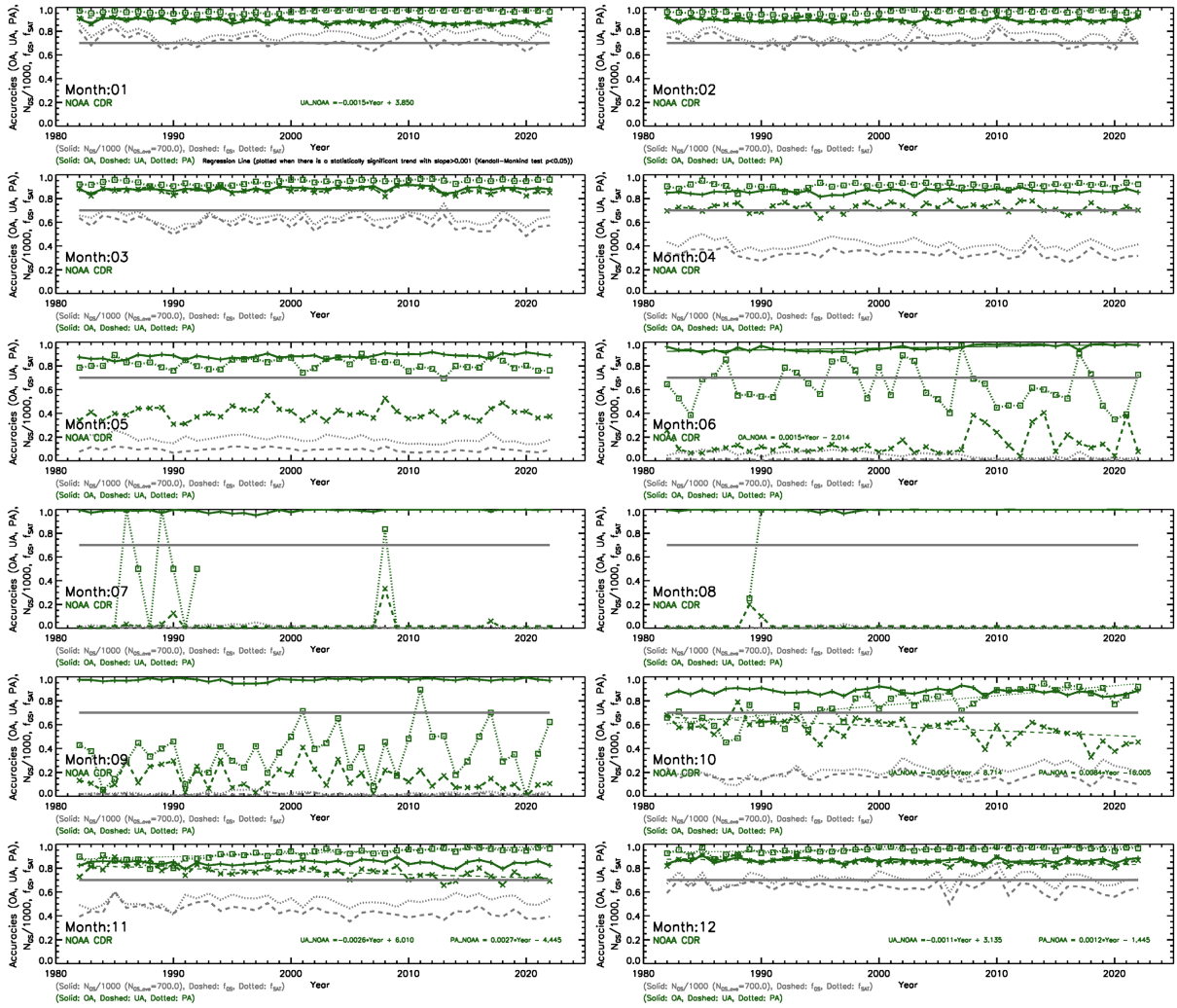


Figure S5: Long-term monthly trends in OA , UA , and PA for NOAA-CDR snow cover products for the period from 1982 to 2022. Linear regression lines and equations with the slope and intercept calculated as the Theil-Sen robust line are shown only when the linear trend is statistically significant (Mann-Kendall test $p < 0.05$) and the slope is larger than $0.001 \text{ [year}^{-1}\text{]}$. Also shown are time series of the number of ground station (N_{GS}) used for the validation (gray solid line), fraction of ground stations where ground stations themselves detected snow cover (f_{GS}) (gray dashed line), and fraction of ground stations where the satellite detected snow cover (f_{SAT}) (gray dotted line).

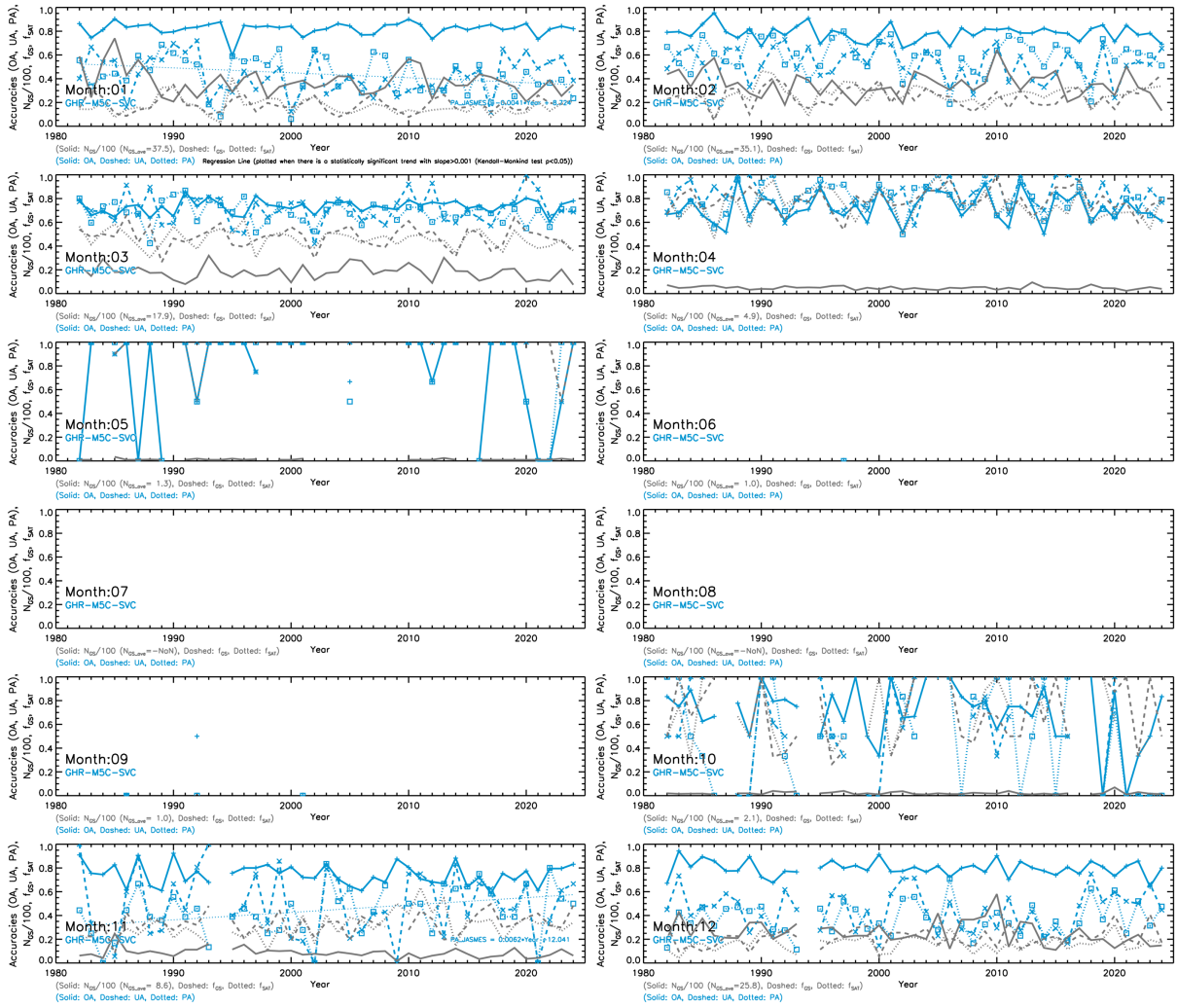


Figure S6: Long-term monthly trends in OA , UA , and PA for GHR-M5C-SVC wet snow cover products for the period from 1982 to 2024. Linear regression lines and equations with the slope and intercept calculated as the Theil-Sen robust line are shown only when the linear trend is statistically significant (Mann-Kendall test $p < 0.05$) and the slope is larger than 0.001 [year⁻¹]. Also shown are time series of the number of ground station (N_{GS}) used for the validation (gray solid line), fraction of ground stations where ground stations themselves detected snow cover (f_{GS}) (gray dashed line), and fraction of ground stations where the satellite detected snow cover (f_{SAT}) (gray dotted line).

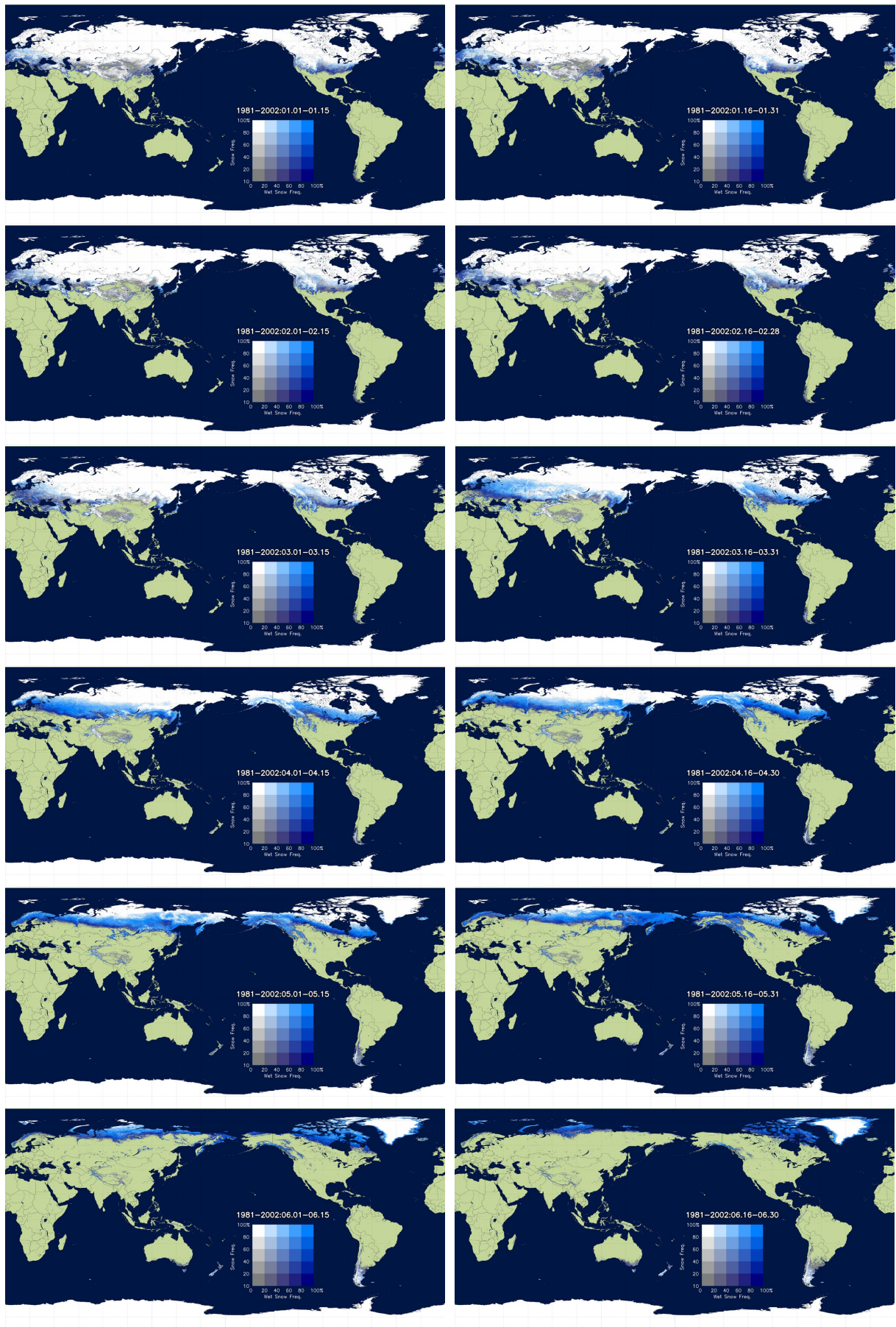


Figure S7: Climatological distribution of the frequency of snow cover and wet snow cover, averaged every half-month, for the period from 1981 to 2002.

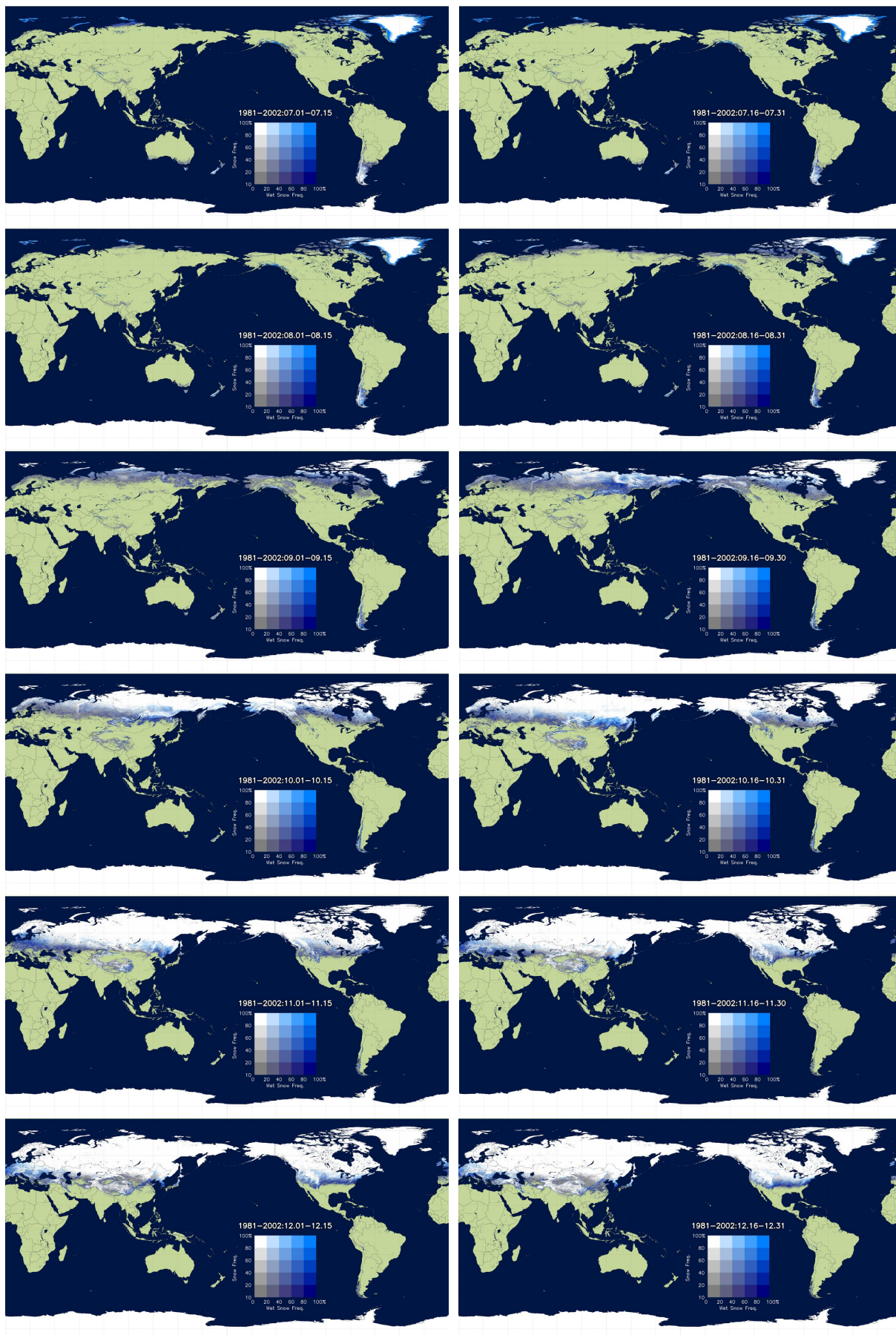


Figure S7 (Cont.): Climatological distribution of the frequency of snow cover and wet snow cover, averaged every half-month, for the period from 1981 to 2002.

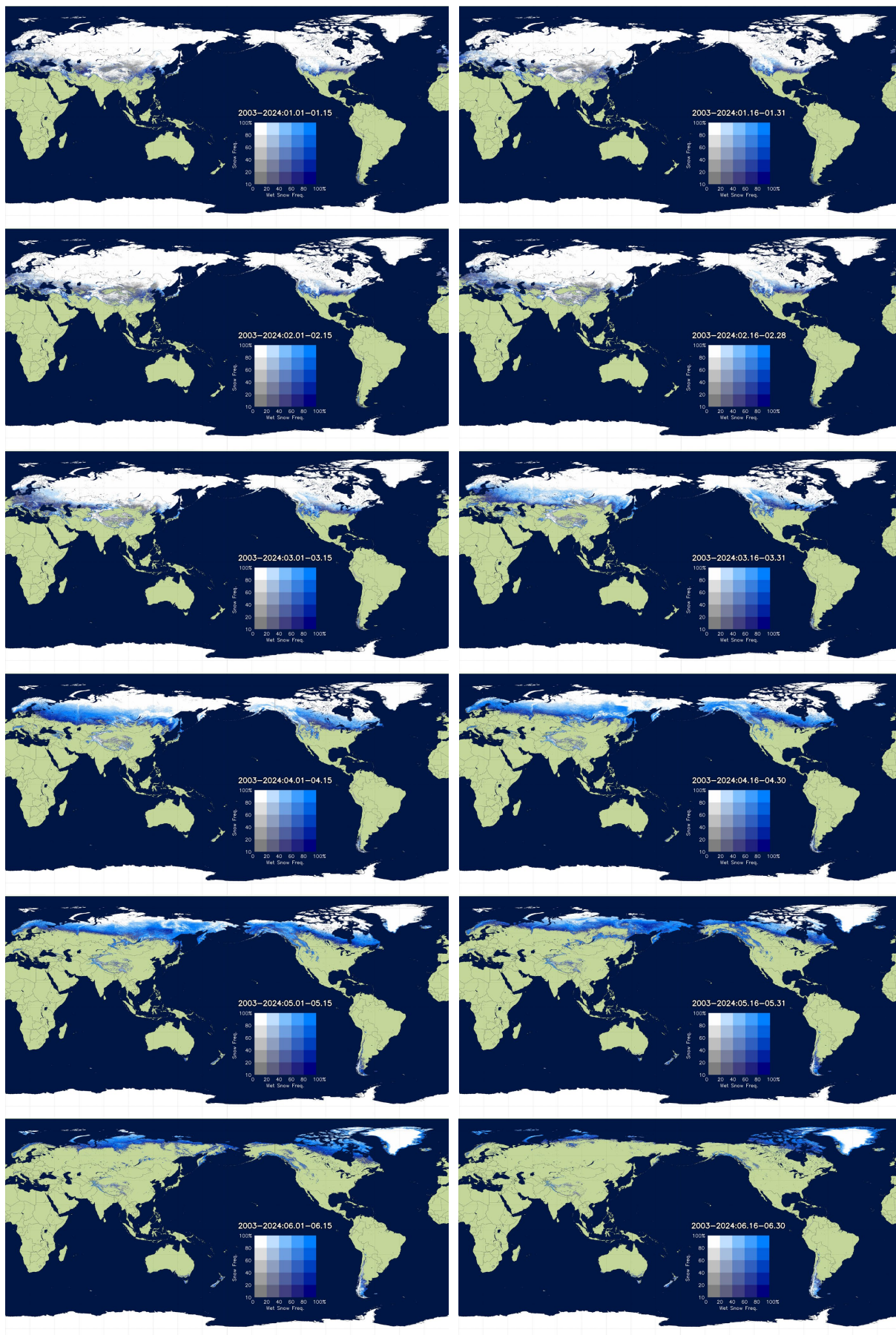


Figure S8: Climatological distribution of the frequency of snow cover and wet snow cover, averaged every half-month, for the period from 2003 to 2024.

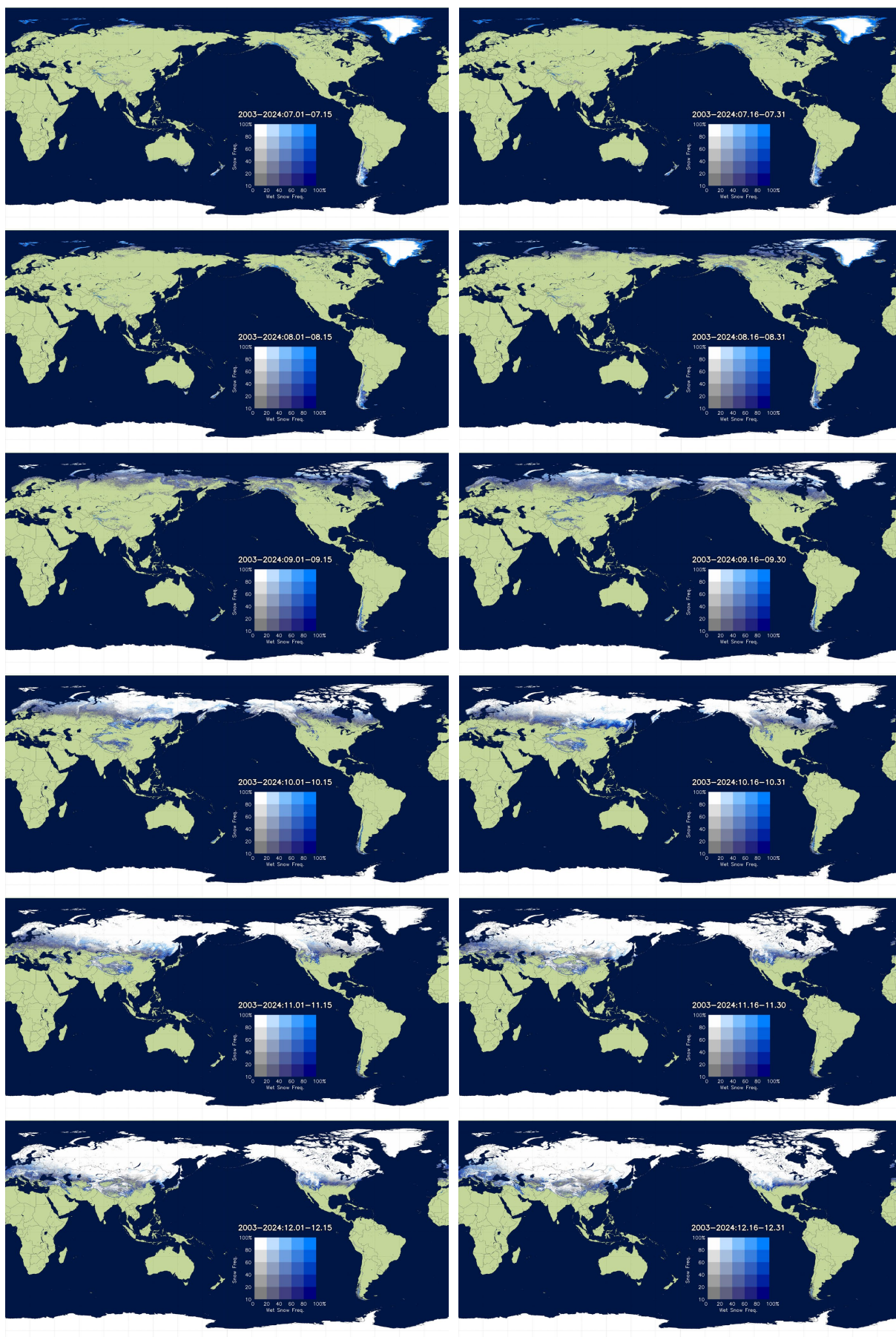


Figure S8 (Cont.): Climatological distribution of the frequency of snow cover and wet snow cover, averaged every half-month, for the period from 2003 to 2024.

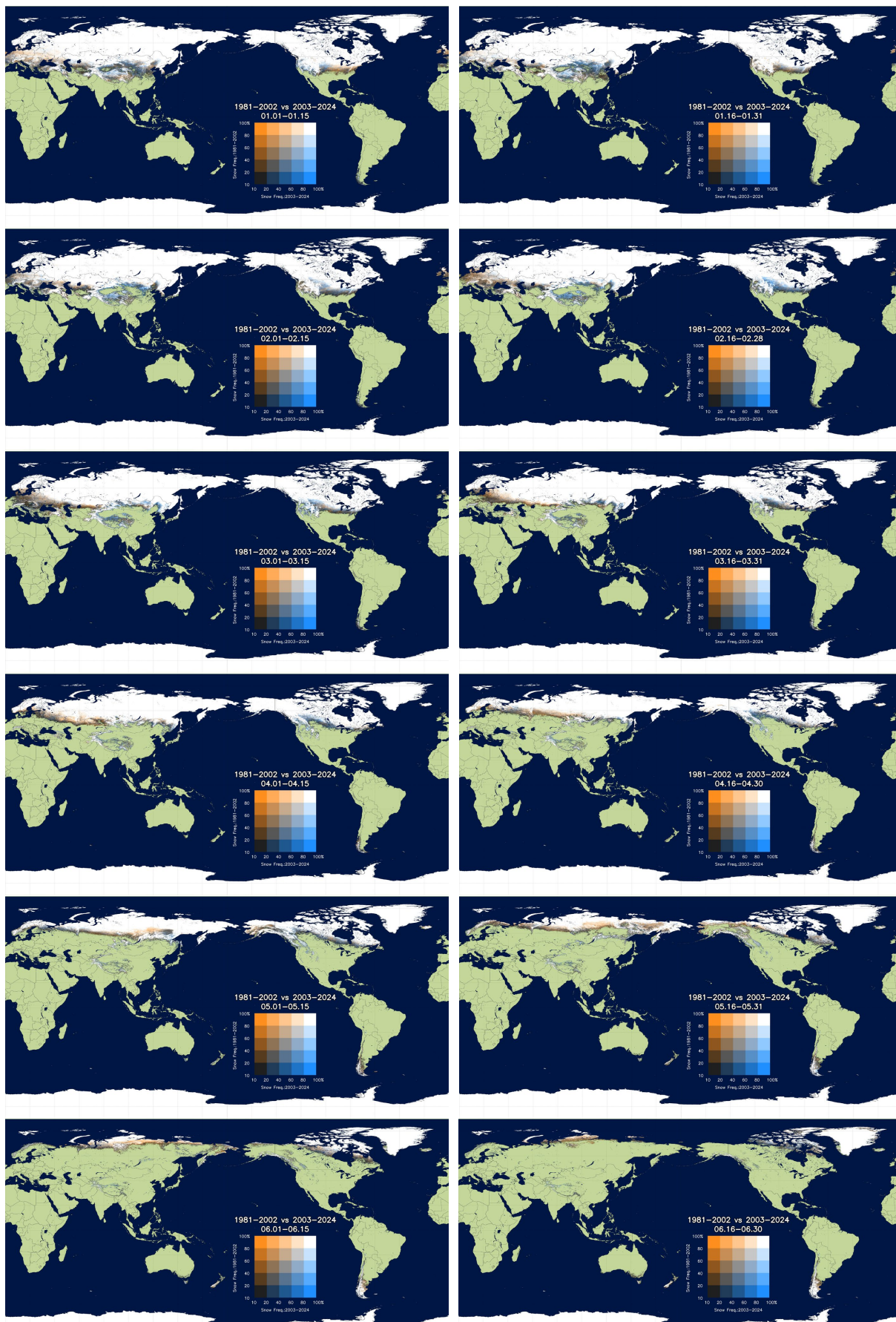


Figure S9: Spatial distribution map showing the average frequency of snow cover every half-month from 1981 to 2002 and from 2003 to 2024. The frequencies from 1981 to 2002 are indicated in shades of orange, and those from 2003 to 2024 in shades of blue (areas with identical frequency across both periods show a gray-to-white gradient).

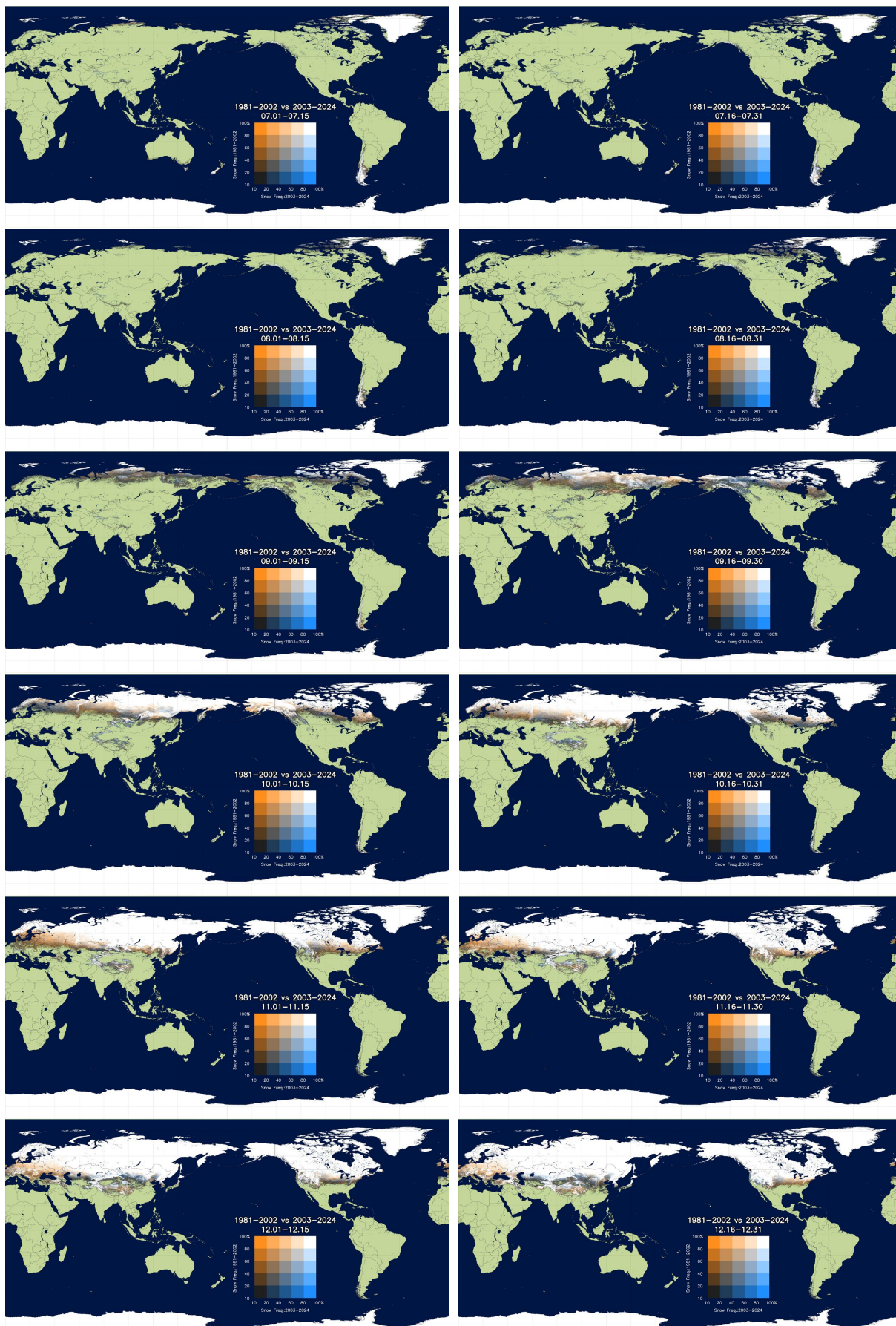


Figure S9 (Cont.): Spatial distribution map showing the average frequency of snow cover every half-month from 1981 to 2002 and from 2003 to 2024. The frequencies from 1981 to 2002 are indicated in shades of orange, and those from 2003 to 2024 in shades of blue (areas with identical frequency across both periods show a gray-to-white gradient).

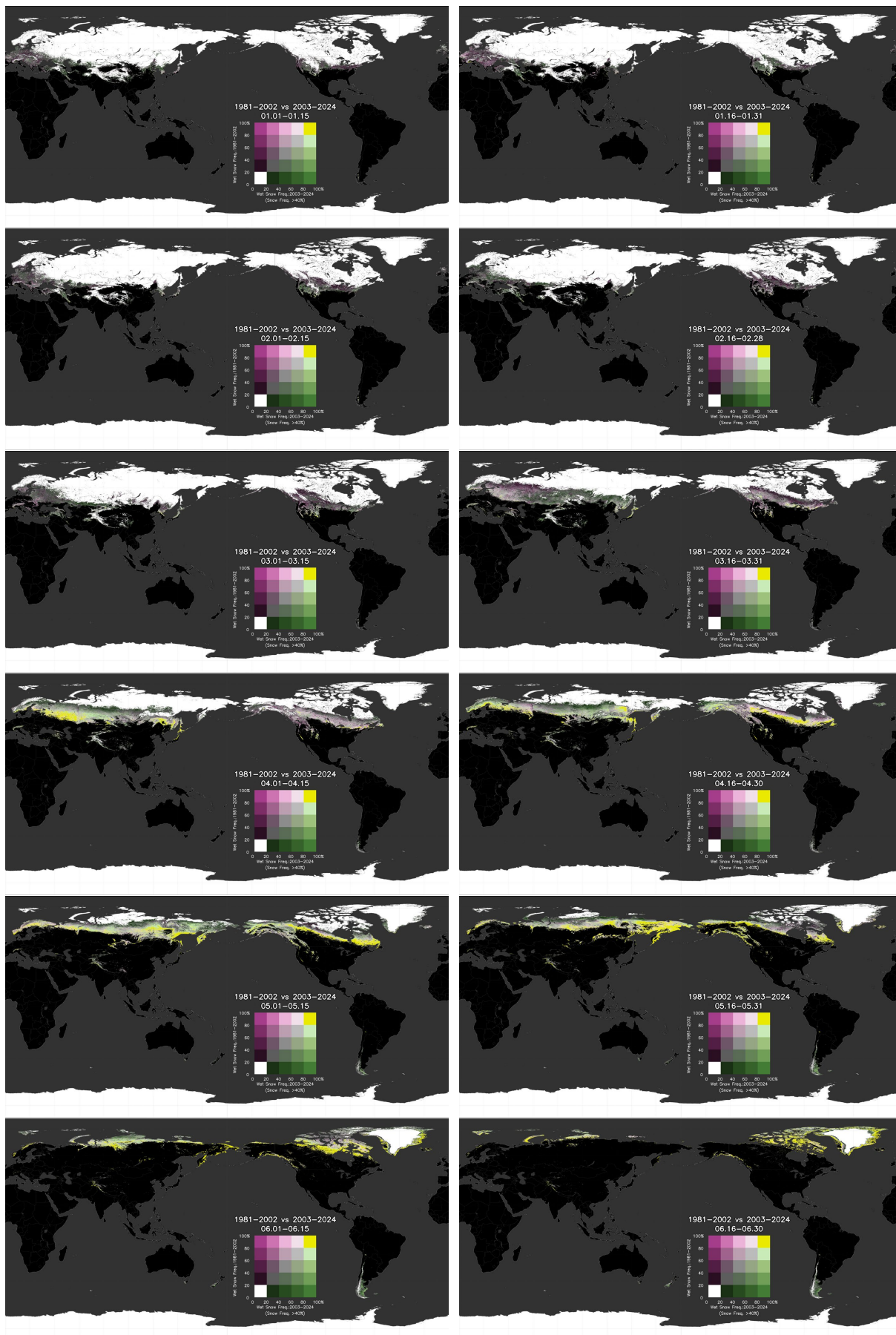


Figure S10: Spatial distribution map showing the average frequency of wet snow cover every half-month from 1981 to 2002 and from 2003 to 2024. The frequencies from 1981 to 2002 are indicated in shades of purple, and those from 2003 to 2024 in shades of dark green (areas with identical frequency across both periods show shades from gray to yellow). Areas with snow cover frequency $\geq 40\%$ in both periods are depicted.

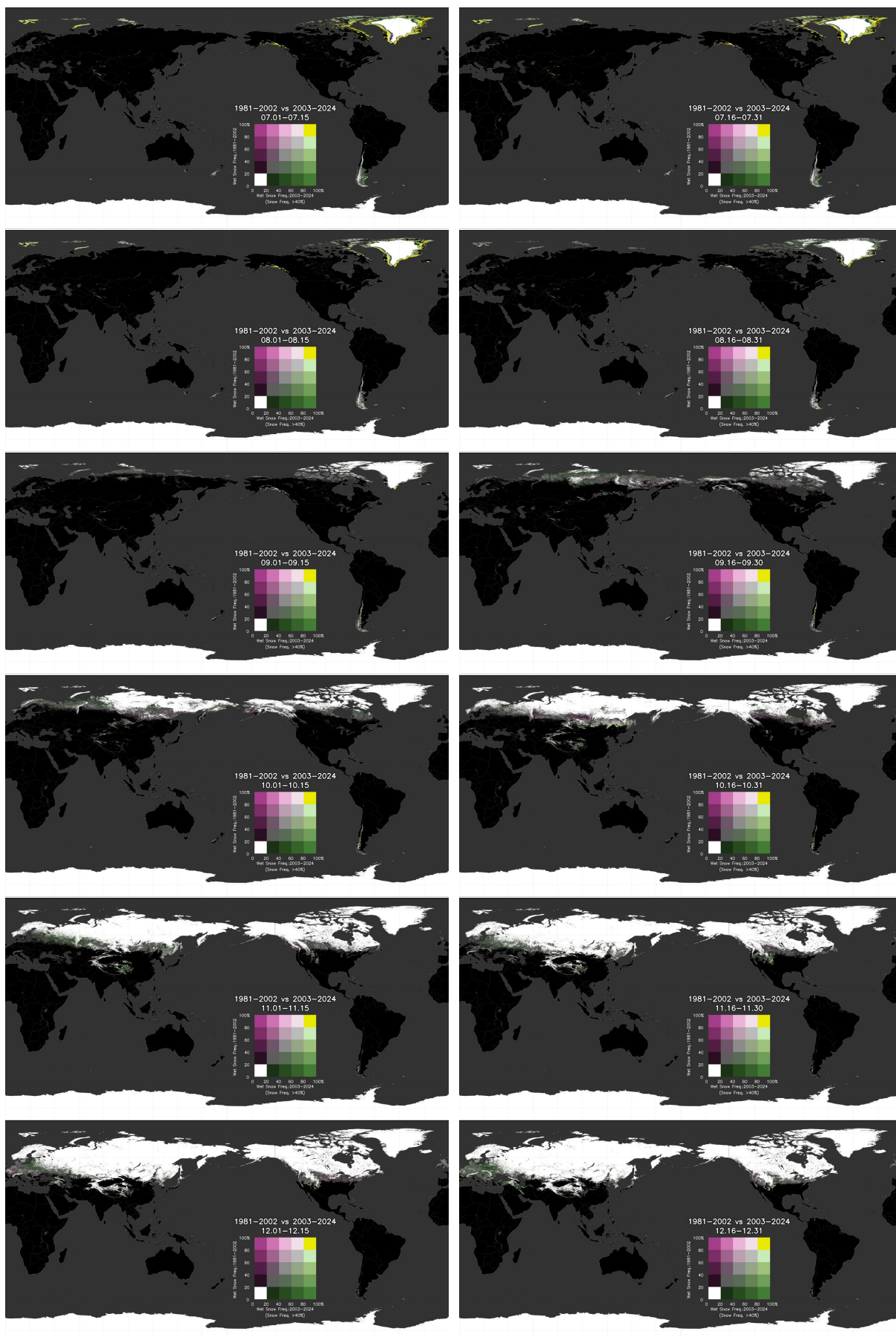


Figure S10 (Cont.): Spatial distribution map showing the average frequency of wet snow cover every half-month from 1981 to 2002 and from 2003 to 2024. The frequencies from 1981 to 2002 are indicated in shades of purple, and those from 2003 to 2024 in shades of dark green (areas with identical frequency across both periods show shades from gray to yellow). Areas with snow cover frequency $\geq 40\%$ in both periods are depicted.