Figure S1: Two-decade evolution of WE-WD NO₂ differences by region across three distinct period: 2004-2013, 2014-2018, 2019-2023 for grid cells with p-value < 0.1.
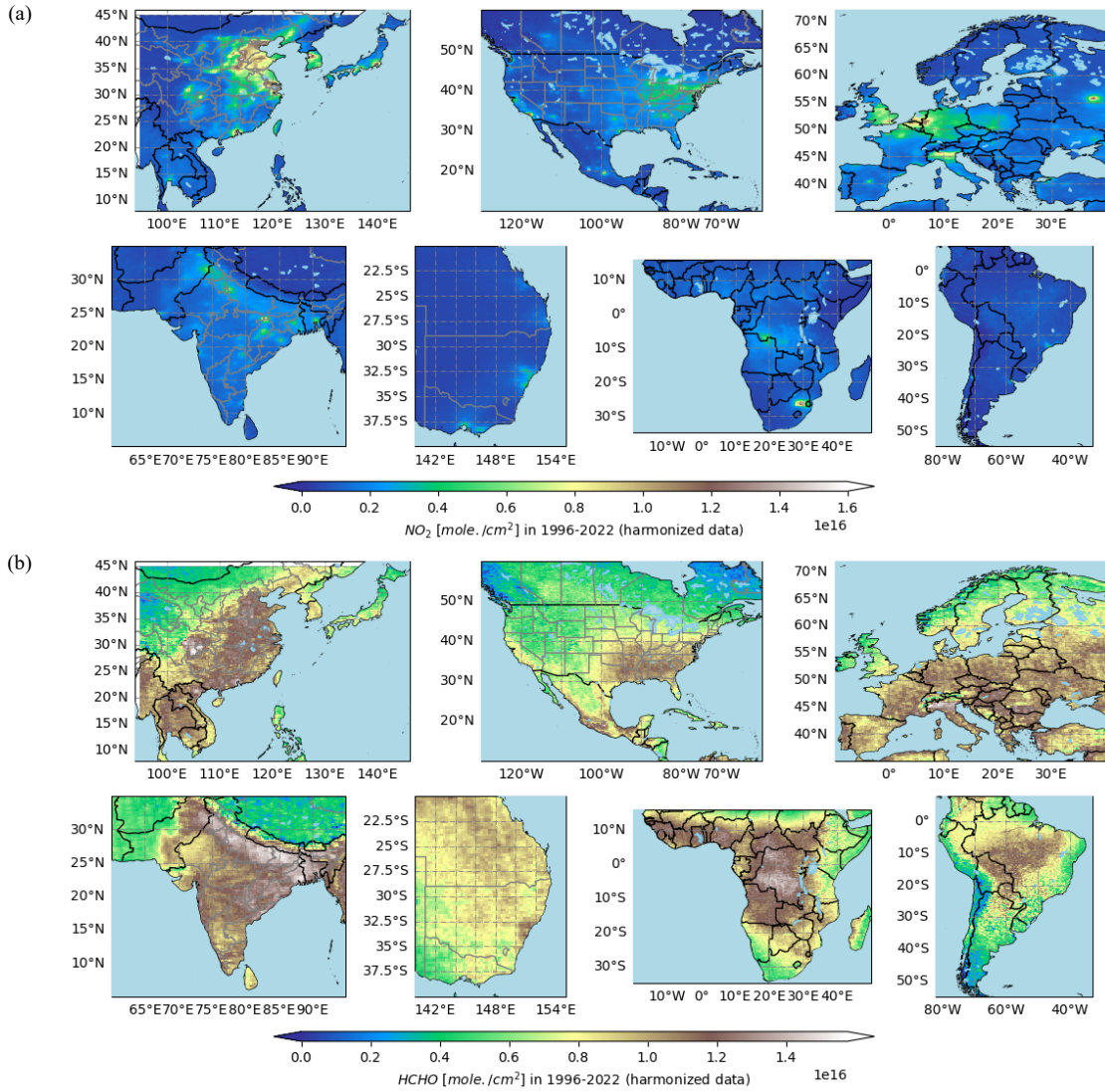
Figure S2: Tropospheric NO₂ and HCHO patterns as seen using the harmonized satellite data for the combined period 1996–2022.
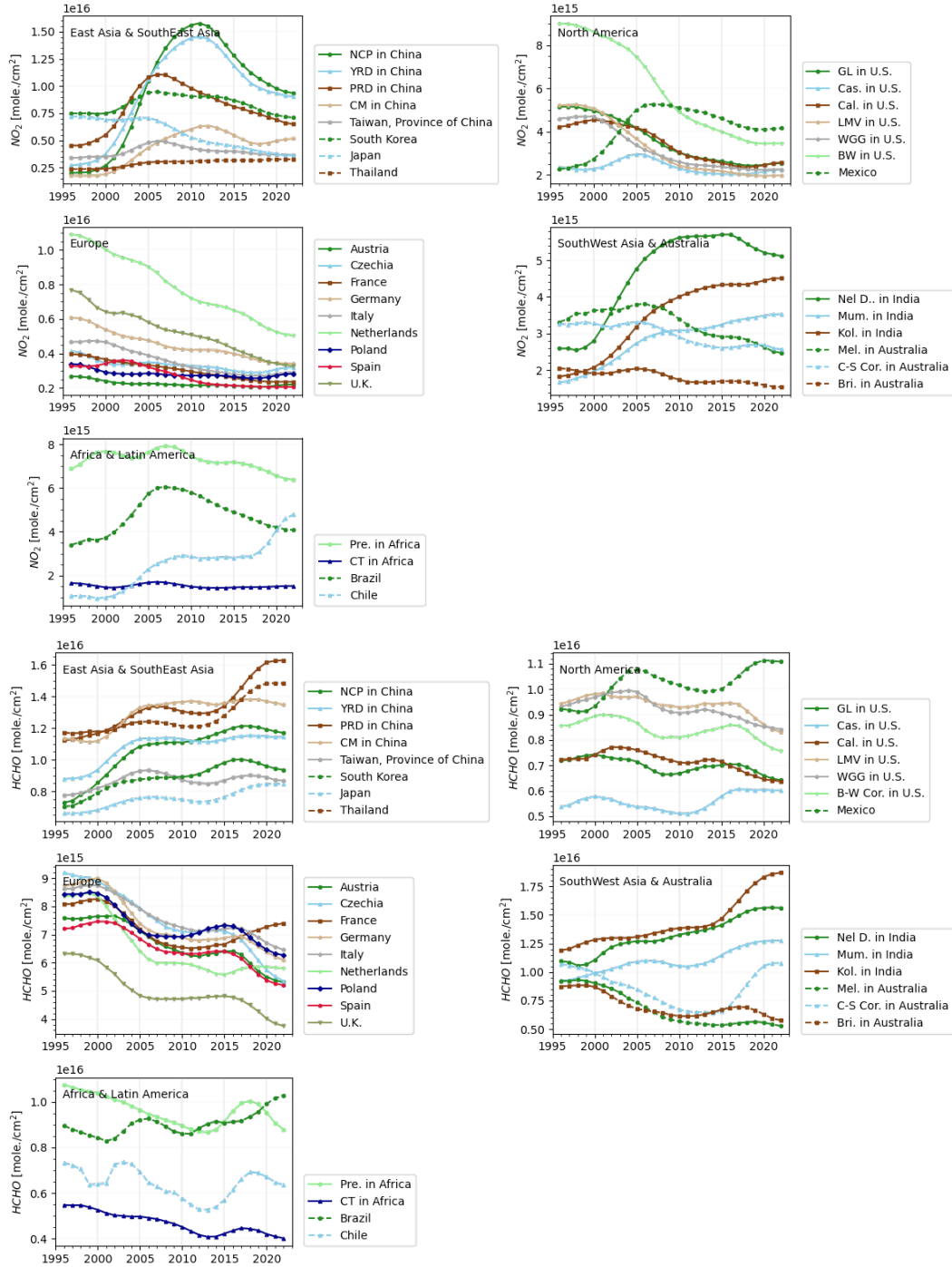
Figure S3: Long-term trends of tropospheric NO₂ and HCHO across major economic regions and selected countries based on the harmonized satellite data.
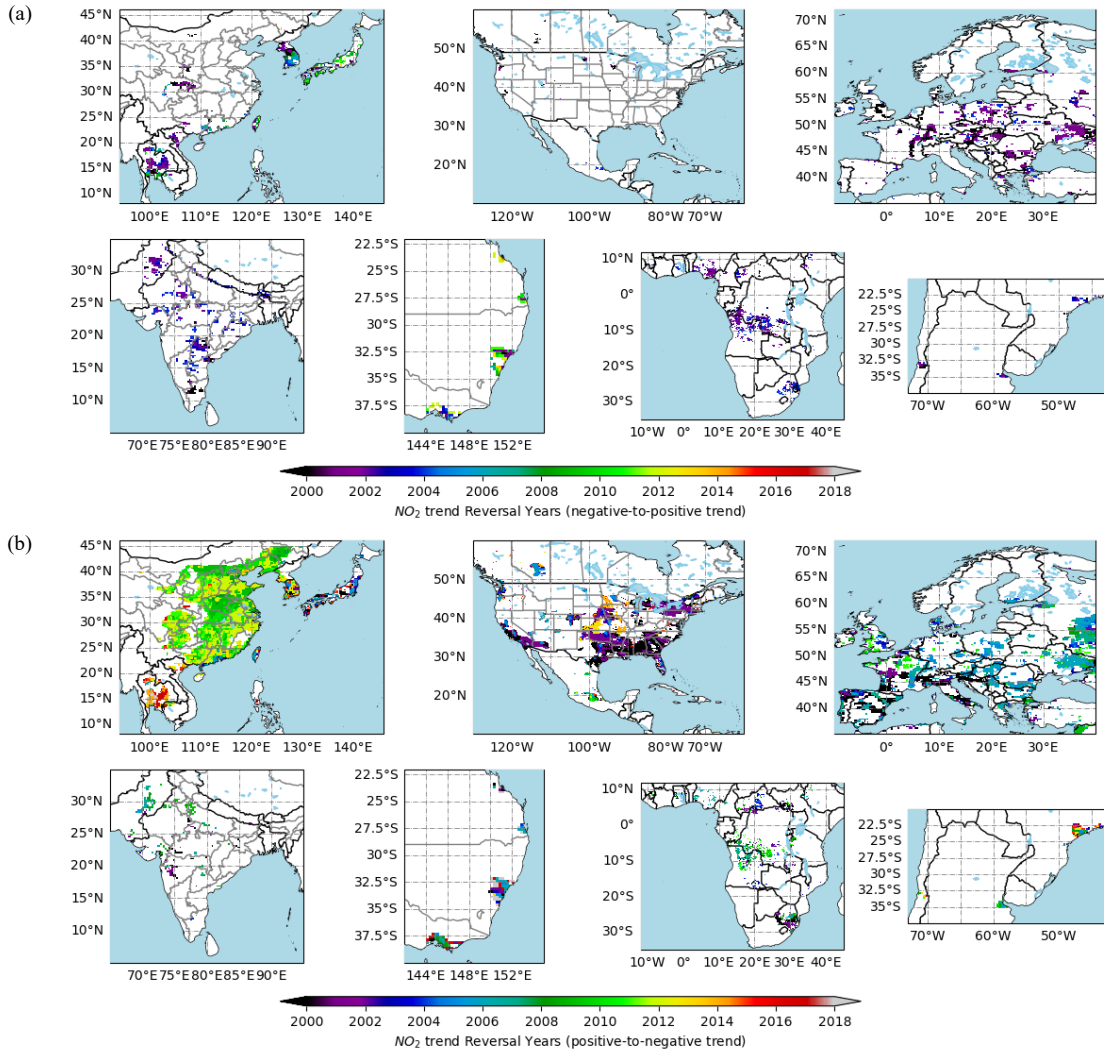
Figure S4: Persistent trend reversals of tropospheric NO₂ ratio: (a) from negative to positive and (b) from positive to negative. Only grids with a with a long-term mean NO₂ VCD > 1.5 × 10¹⁵ (molecules · cm⁻²) and statistically significant trends with p value < 0.05 for the period before and after the year of reversals are shown.

Figure S5: Map of WE-WD O$_3$ Theil–Sen slope (upper panel) and p-value for the trend of timeseries using Mann–Kendall test (lower panel).