

Figure S1: Spatial distribution of total monthly rainfall (cm) of normal monsoon (2016).

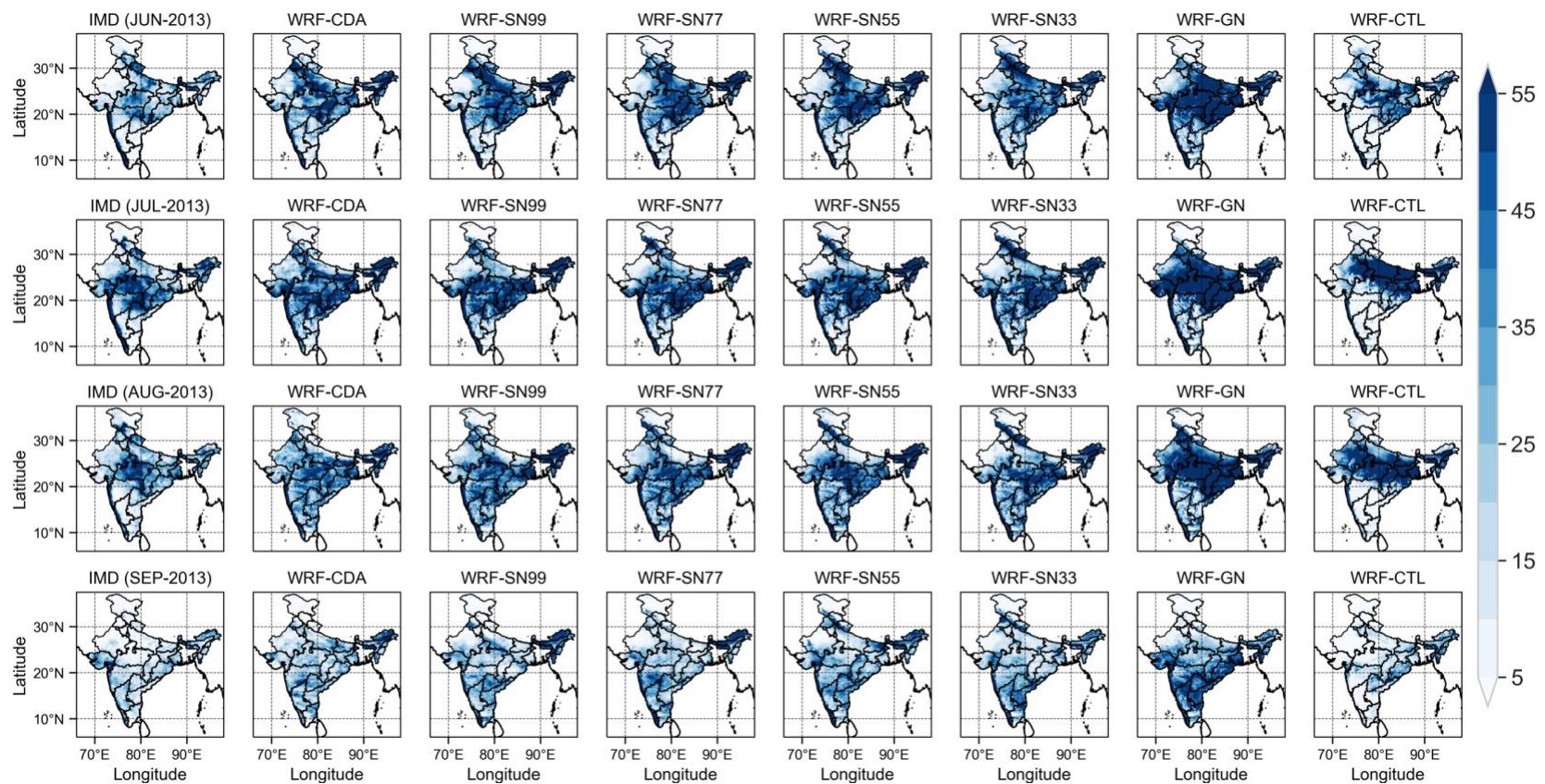


Figure S2: Spatial distribution of total monthly rainfall (cm) of excess monsoon (2013).

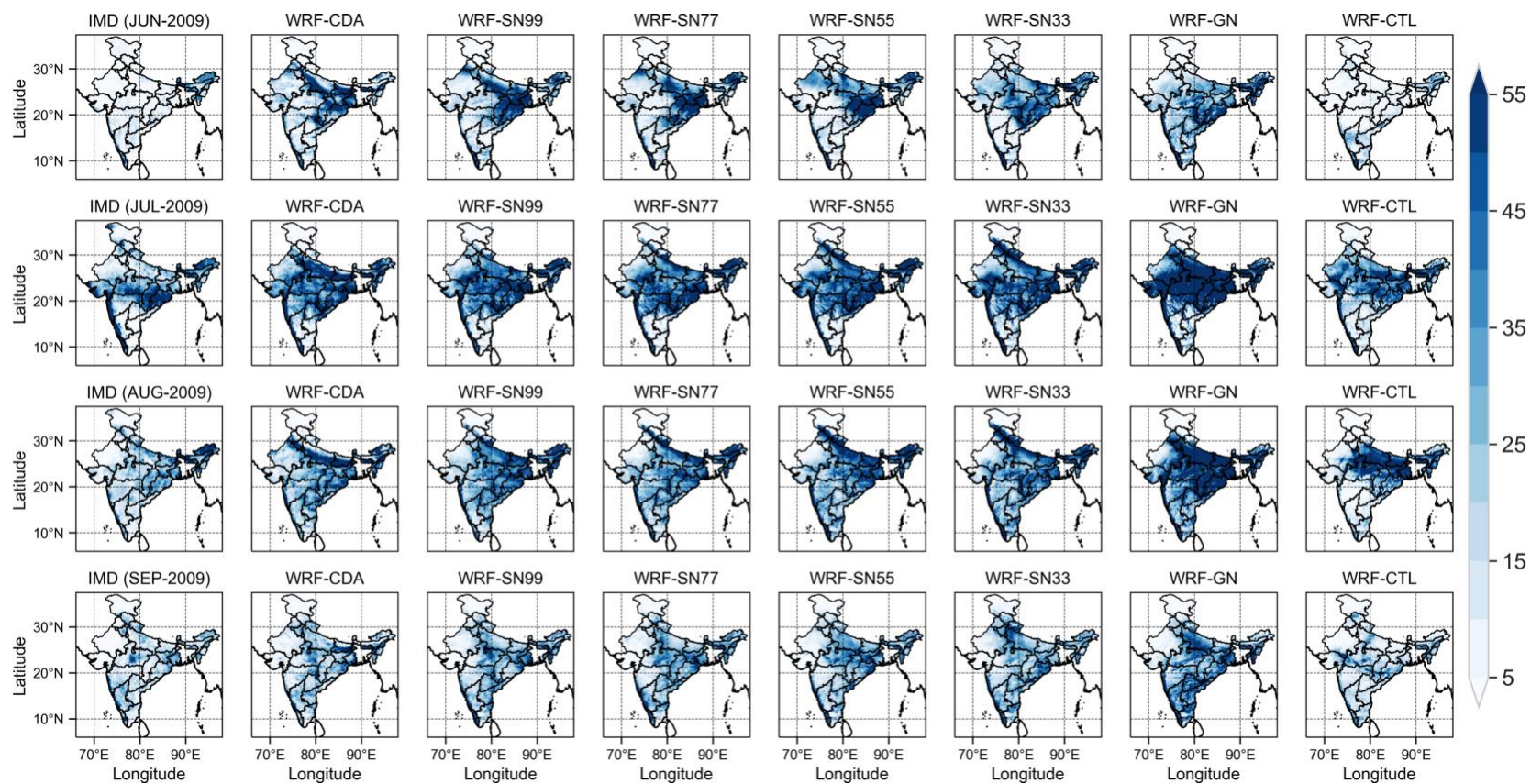


Figure S3: Spatial distribution of total monthly rainfall (cm) of drought monsoon (2009).

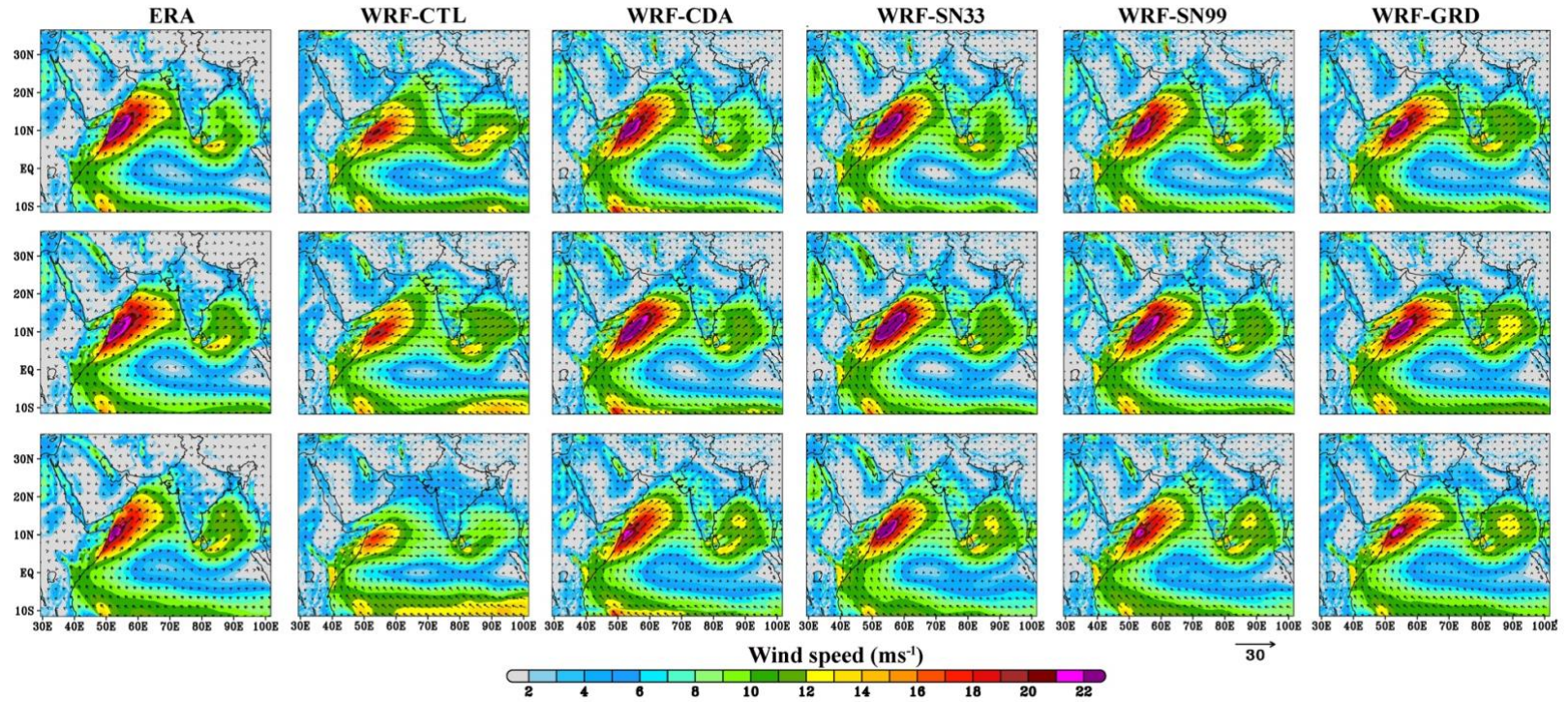


Figure S4: The mean seasonal winds (m/s) at 950 hPa during normal (2016), excess (2013), and drought (2009) Indian Summer Monsoon seasons. First, second, third, fourth, fifth, and sixth columns are for the ERA5, WRF-CTL, WRF-CDA, WRF-SN33, WRF-SN99, and WRF-GN, respectively. First row is for normal, second row is for excess, and third row is for drought Indian Summer Monsoon seasons.

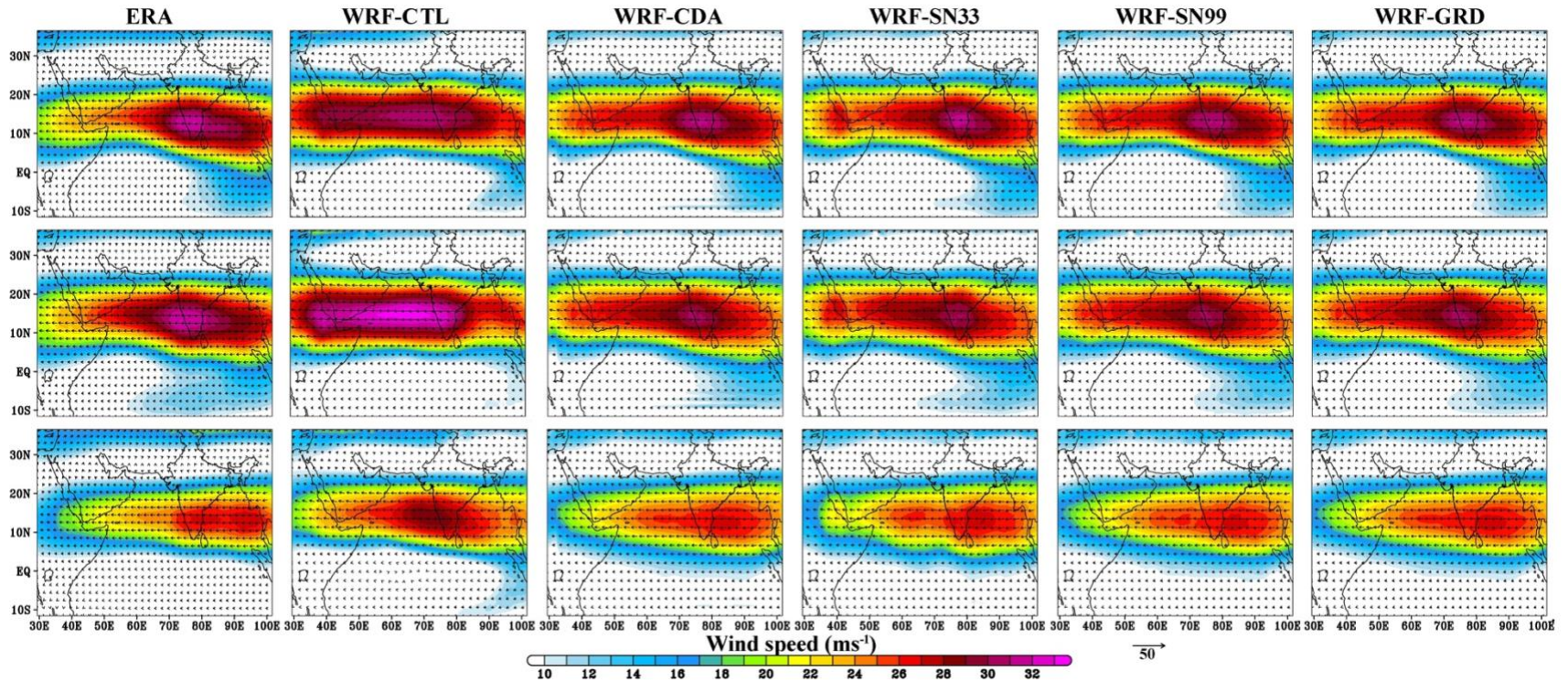


Figure S5: The mean seasonal winds (m/s) at 100 hPa during normal (2016), excess (2013), and drought (2009) Indian Summer Monsoon seasons. First, second, third, fourth, fifth, and sixth columns are for the ERA5, WRF-CTL, WRF-CDA, WRF-SN33, WRF-SN99, and WRF-GN, respectively. First row is for normal, second row is for excess, and third row is for drought Indian Summer Monsoon seasons.

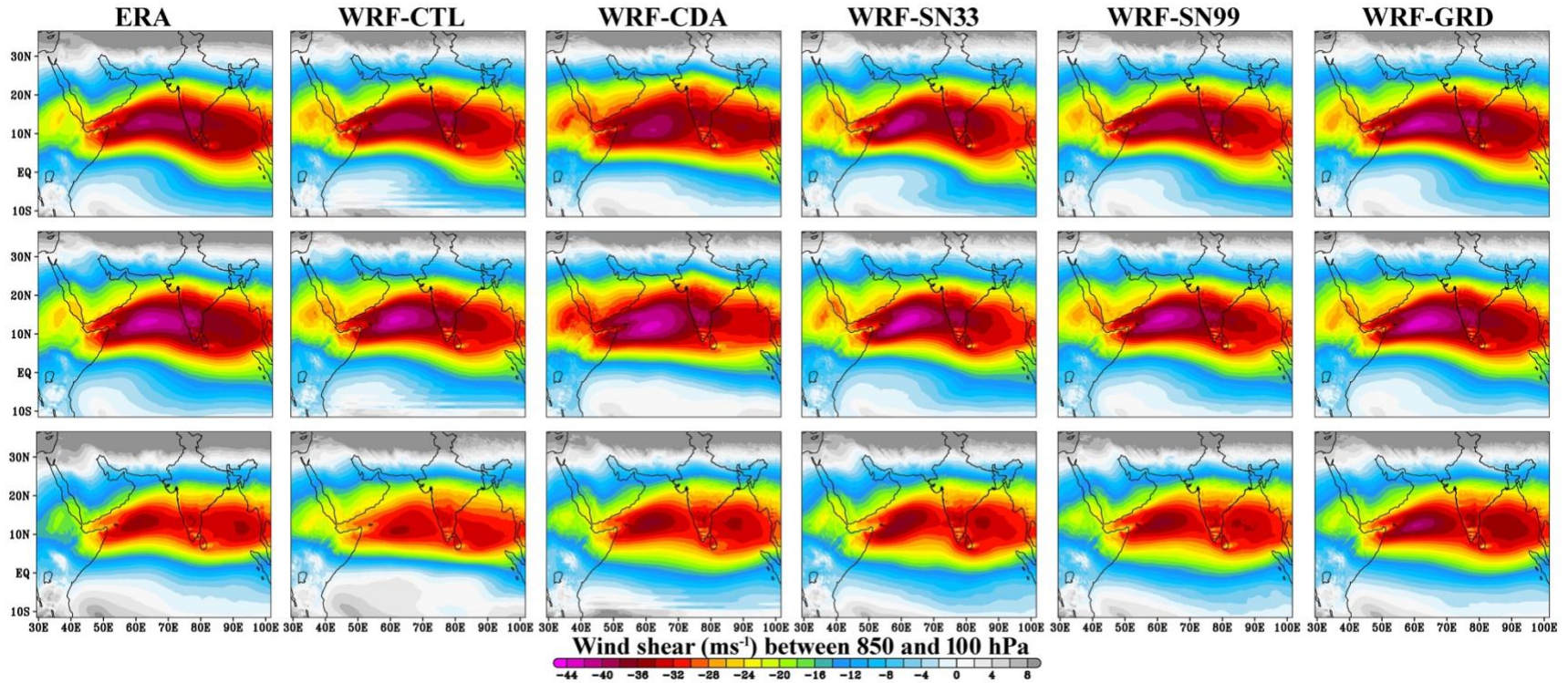


Figure S6: The mean seasonal zonal wind shear (m/s) between 850 hPa and 100 hPa levels during normal (2016), excess (2013), and drought (2009) Indian Summer Monsoon seasons. First, second, third, fourth, fifth, and sixth columns are for the ERA5, WRF-CTL, WRF-CDA, WRF-SN33, WRF-SN99, and WRF-GN, respectively. First row is for normal, second row is for excess, and third row is for drought Indian Summer Monsoon seasons.

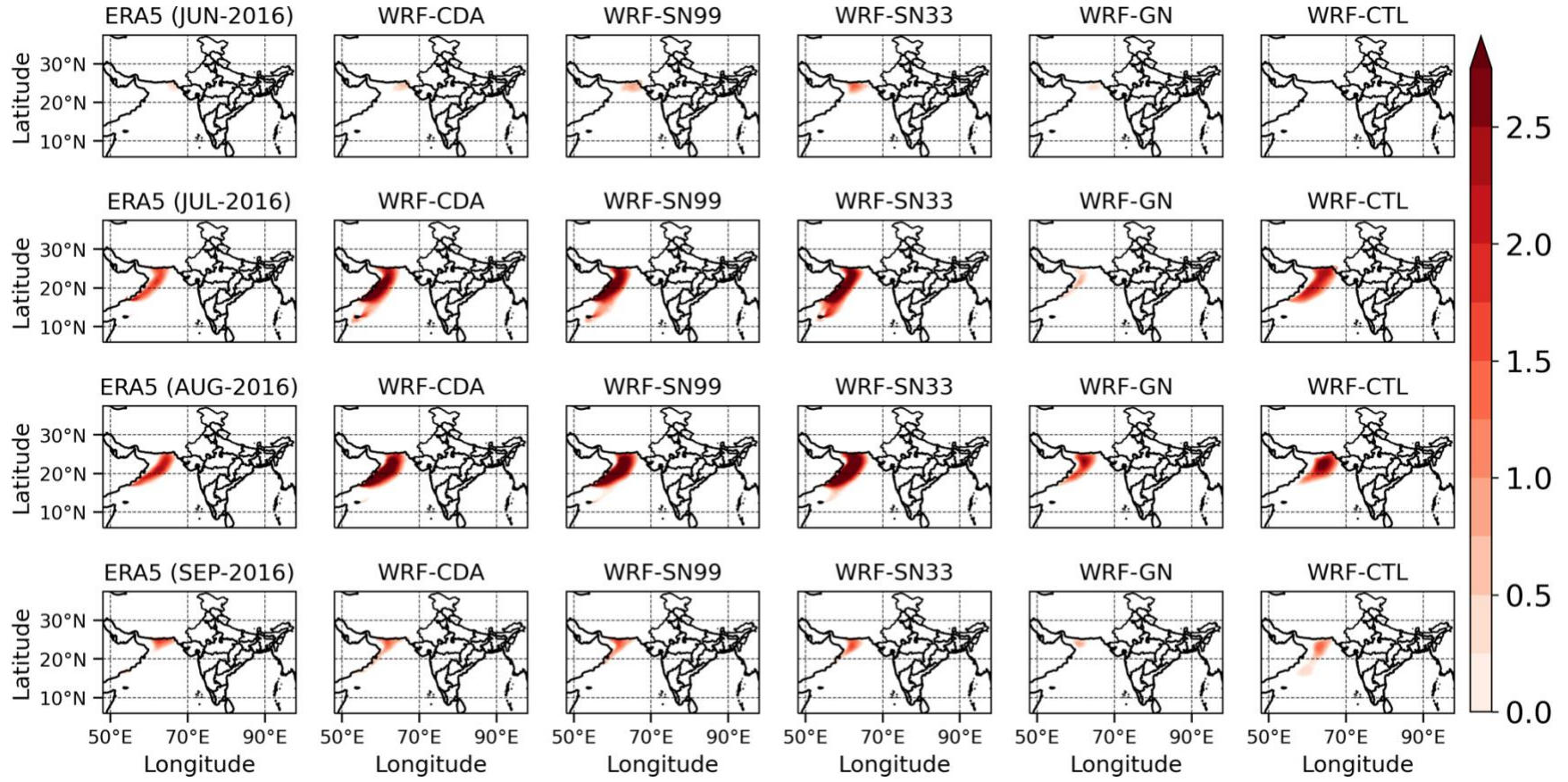


Figure S7: The mean monthly monsoon inversion (K, differences in the temperature between the 850 and 950 [$\Delta T = T_{850 \text{ hPa}} - T_{950 \text{ hPa}}$]) for normal (2016) Indian Summer Monsoon Season.

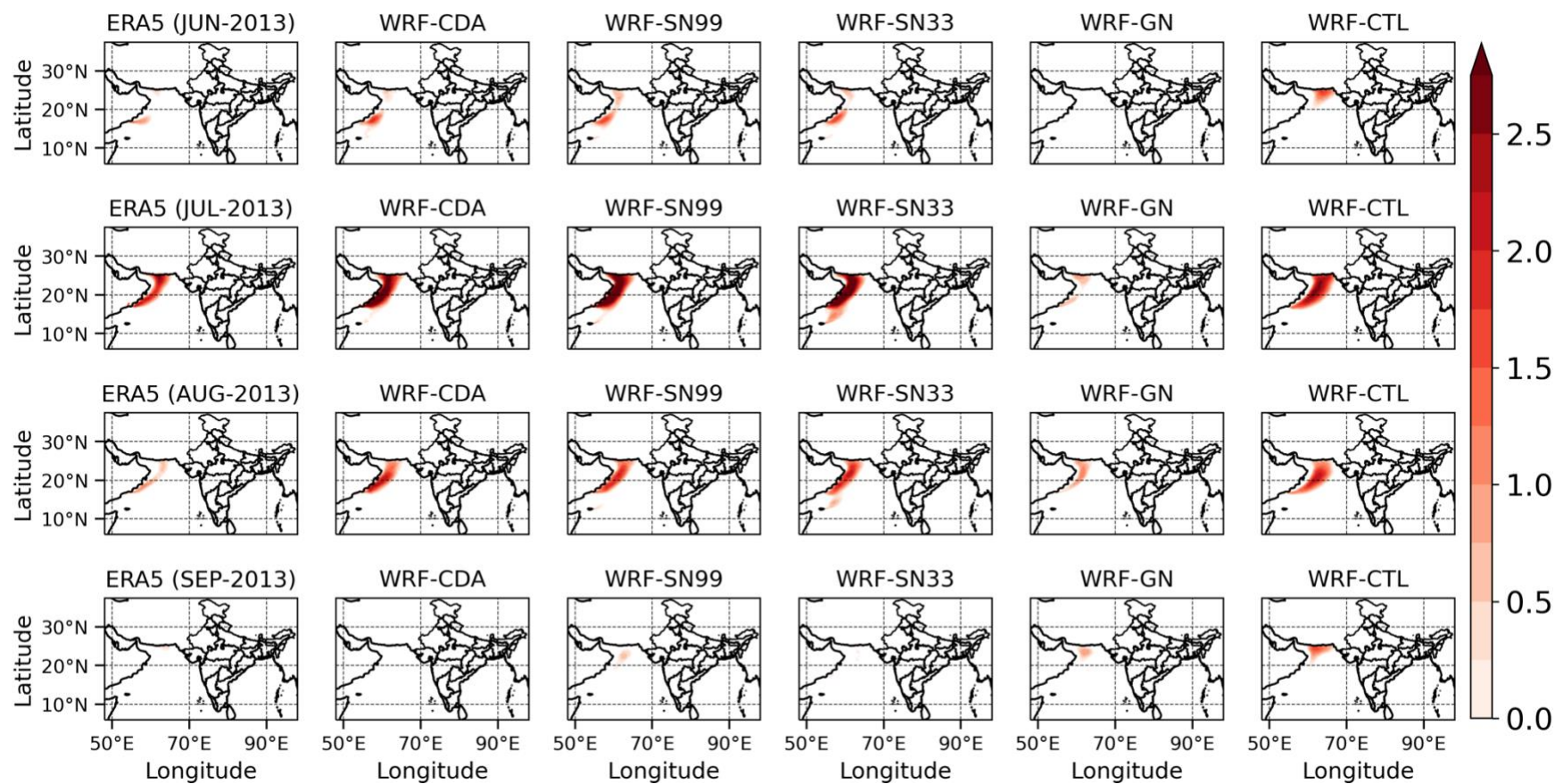


Figure S8: The mean monthly monsoon inversion (K, differences in the temperature between the 850 and 950 [$\Delta T = T_{850 \text{ hPa}} - T_{950 \text{ hPa}}$]) for excess (2013) Indian Summer Monsoon Season.

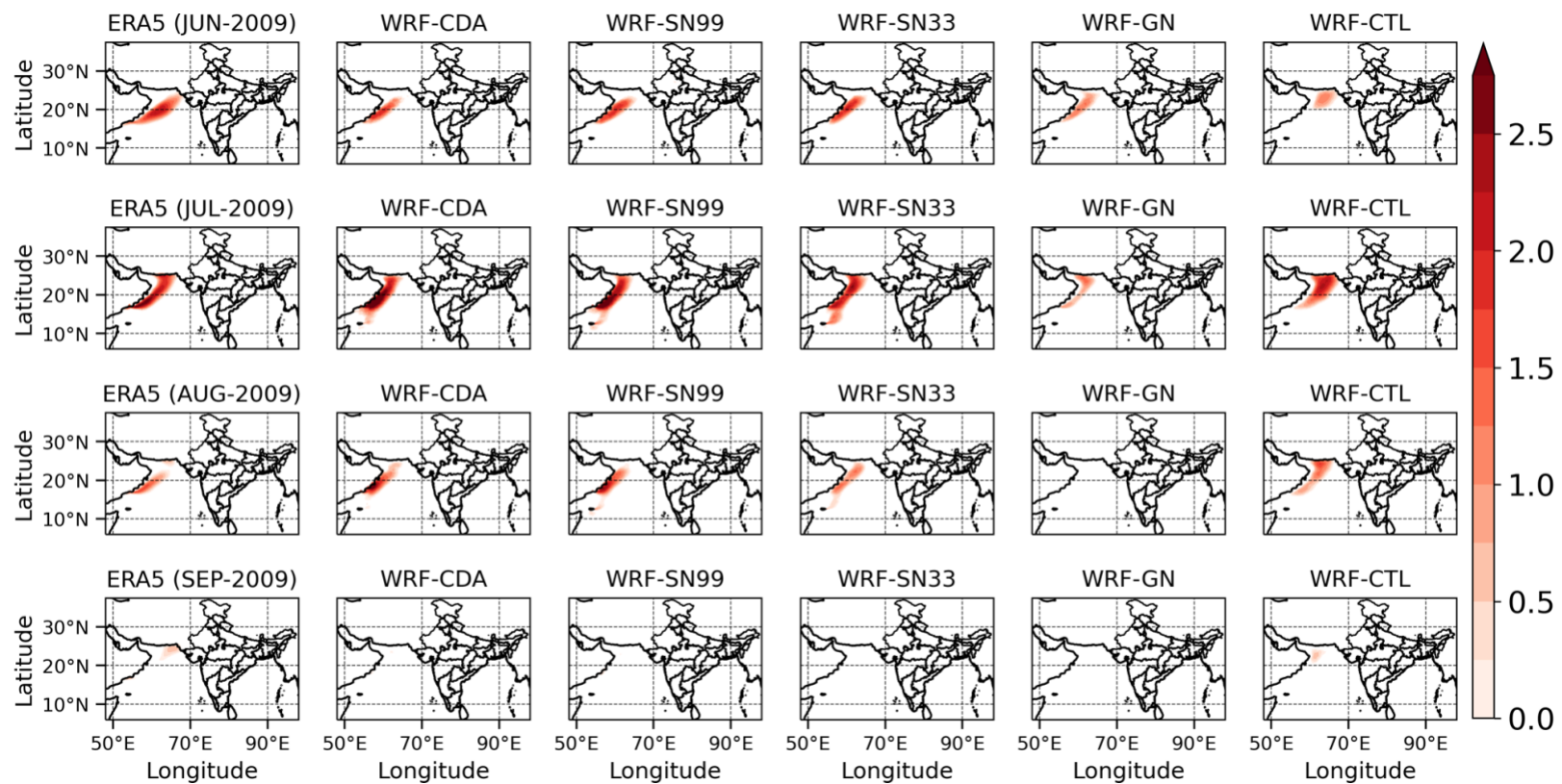


Figure S9: The mean monthly monsoon inversion (K, differences in the temperature between the 850 and 950 [$\Delta T = T_{850 \text{ hPa}} - T_{950 \text{ hPa}}$]) for drought (2009) Indian Summer Monsoon Season.