

Supplementary Material for the paper “Interactions among the Phenological Events of Winter Wheat in the North China Plain-Based on Field Data and Improved MODIS Estimation”

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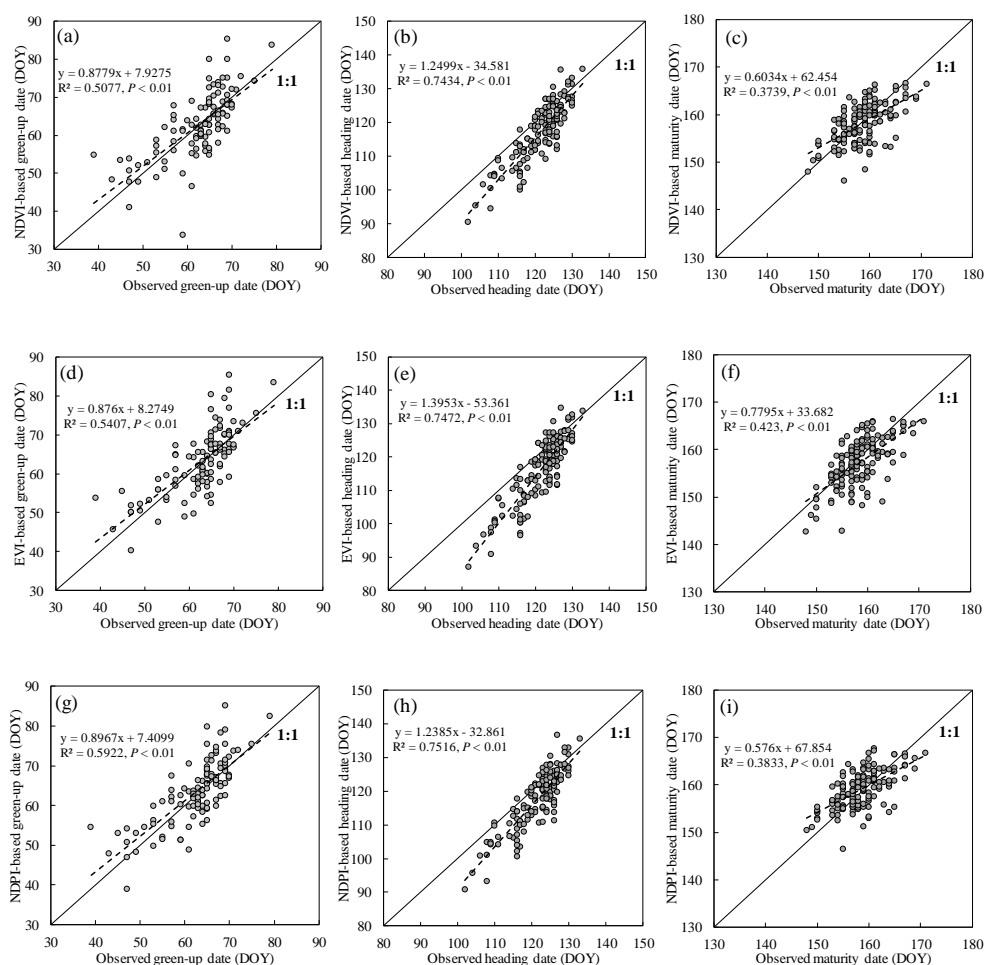


Figure S1. Comparison between satellite-based winter wheat phenology and ground observations. (a)–(c) refer to comparisons between green-up date, heading date and maturity date derived from NDVI and ground-observed green-up date, heading date, and maturity date, respectively; (d)–(f) refer to comparisons between green-up date, heading date and maturity date derived from EVI and ground-observed green-up date, heading date, and maturity date, respectively; (g)–(i) refer to

comparisons between green-up date, heading date and maturity date derived from NDVI and ground-observed green-up date, heading date, and maturity date, respectively.

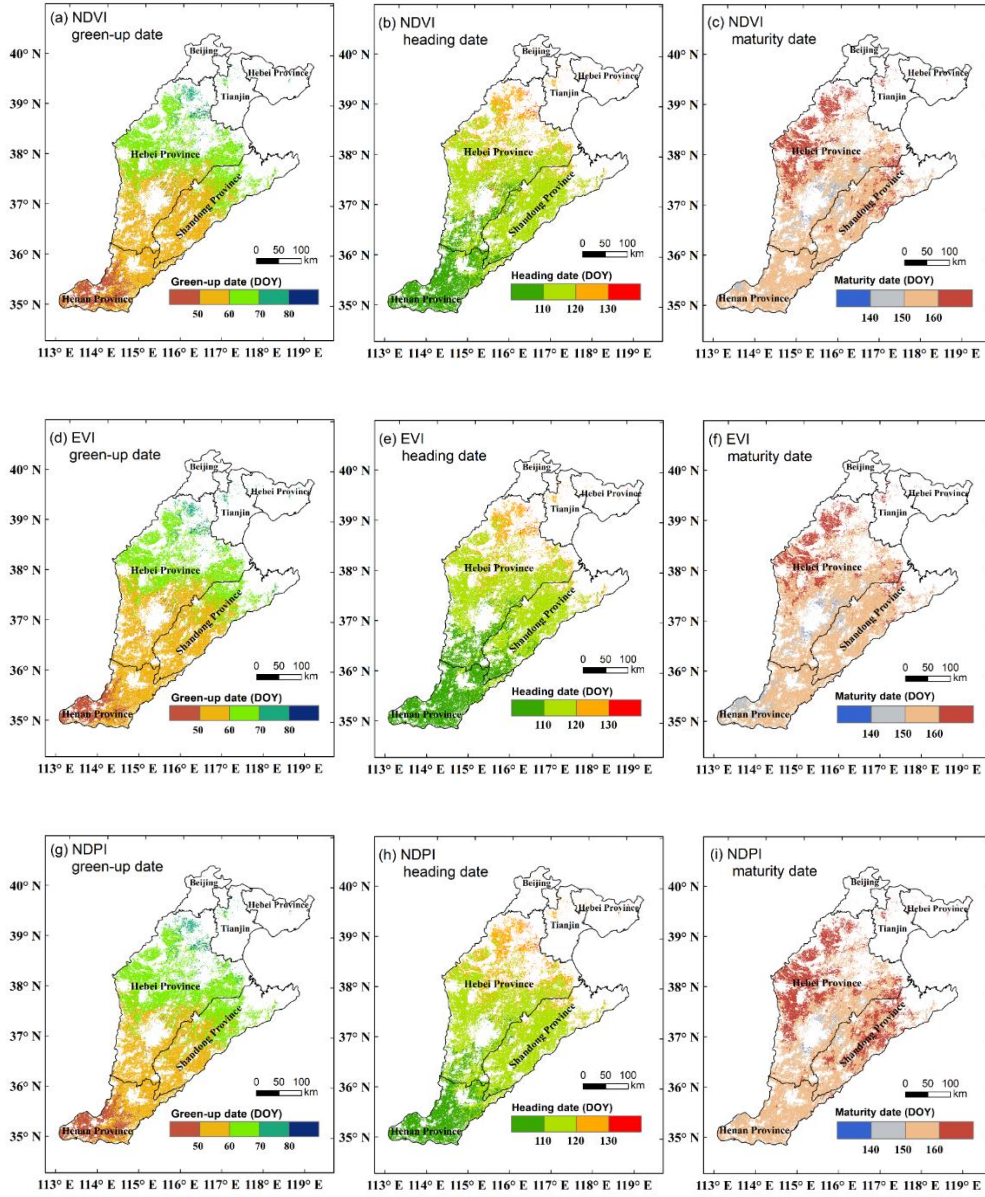


Figure S2. Average spatial pattern of winter wheat phenological events derived from NDVI, EVI and NDPI during 2001-2018. (a-c) refers to the green-up date, heading date and maturity date of winter wheat derived from NDVI, respectively; (d-f) refers to the green-up date, heading date and maturity date of winter wheat derived from EVI, respectively; (g-i) refers to the green-up date, heading date and maturity date of winter wheat derived from NDPI, respectively.

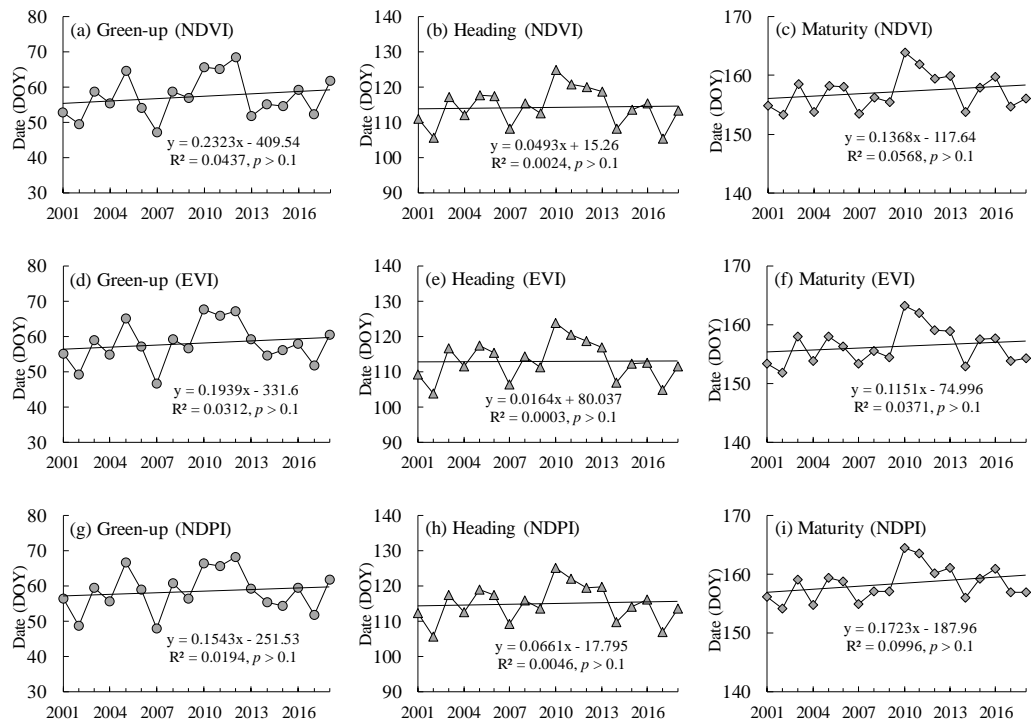


Figure S3. Inter-annual trend of satellite-based green-up date, heading date and maturity date derived from NDVI, EVI, and NDPI during 2001-2018.

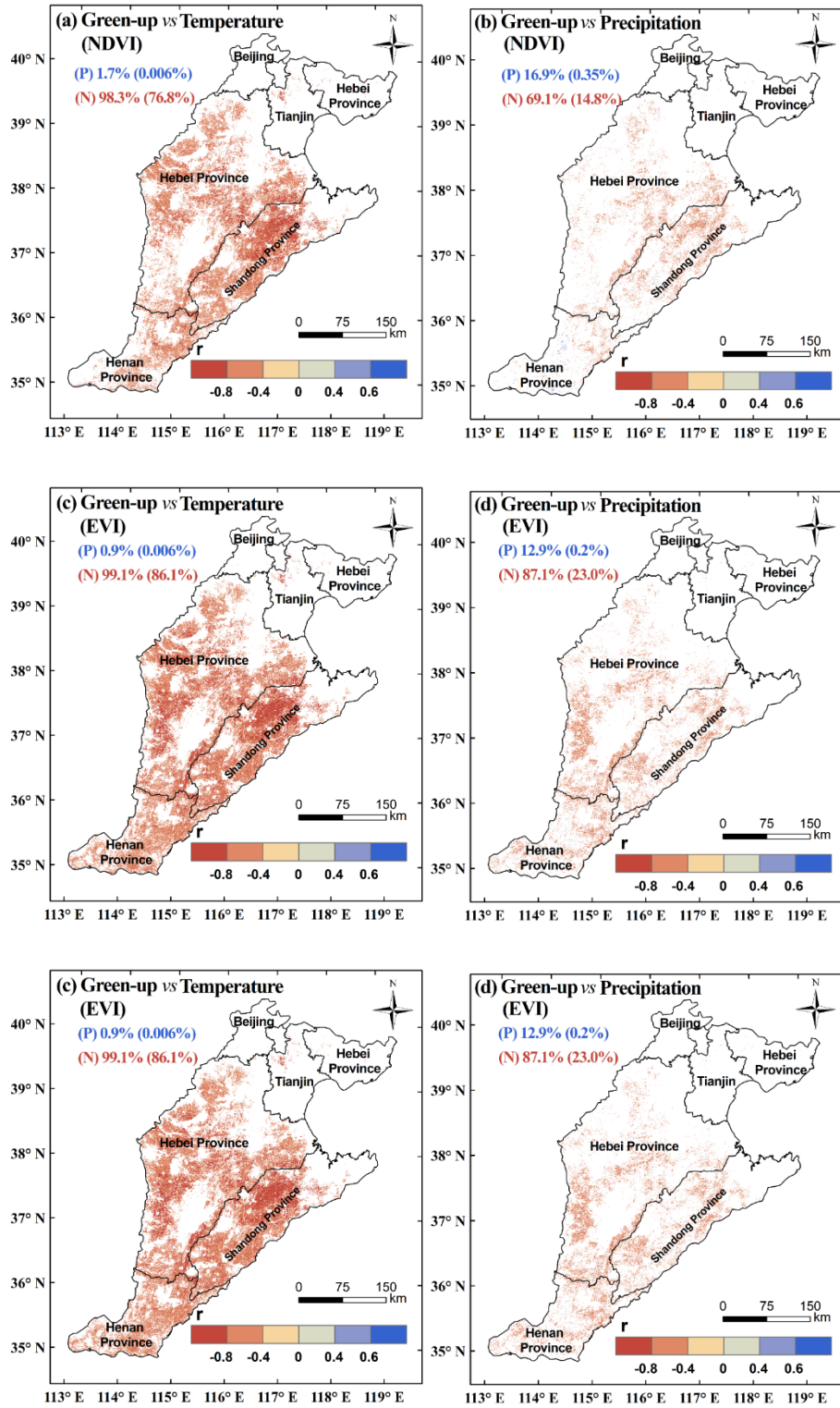


Figure S4. Partial correlation coefficient between green-up date of winter wheat derived from NDVI (a,b), EVI (c,d) and NDPI (e,f) and the mean temperature from January to March and the cumulative precipitation from December to March. Dotted regions indicated the detected correlation were significant ($p < 0.05$). (P) refers to the positive correlation, (N) refers to the negative correlation.

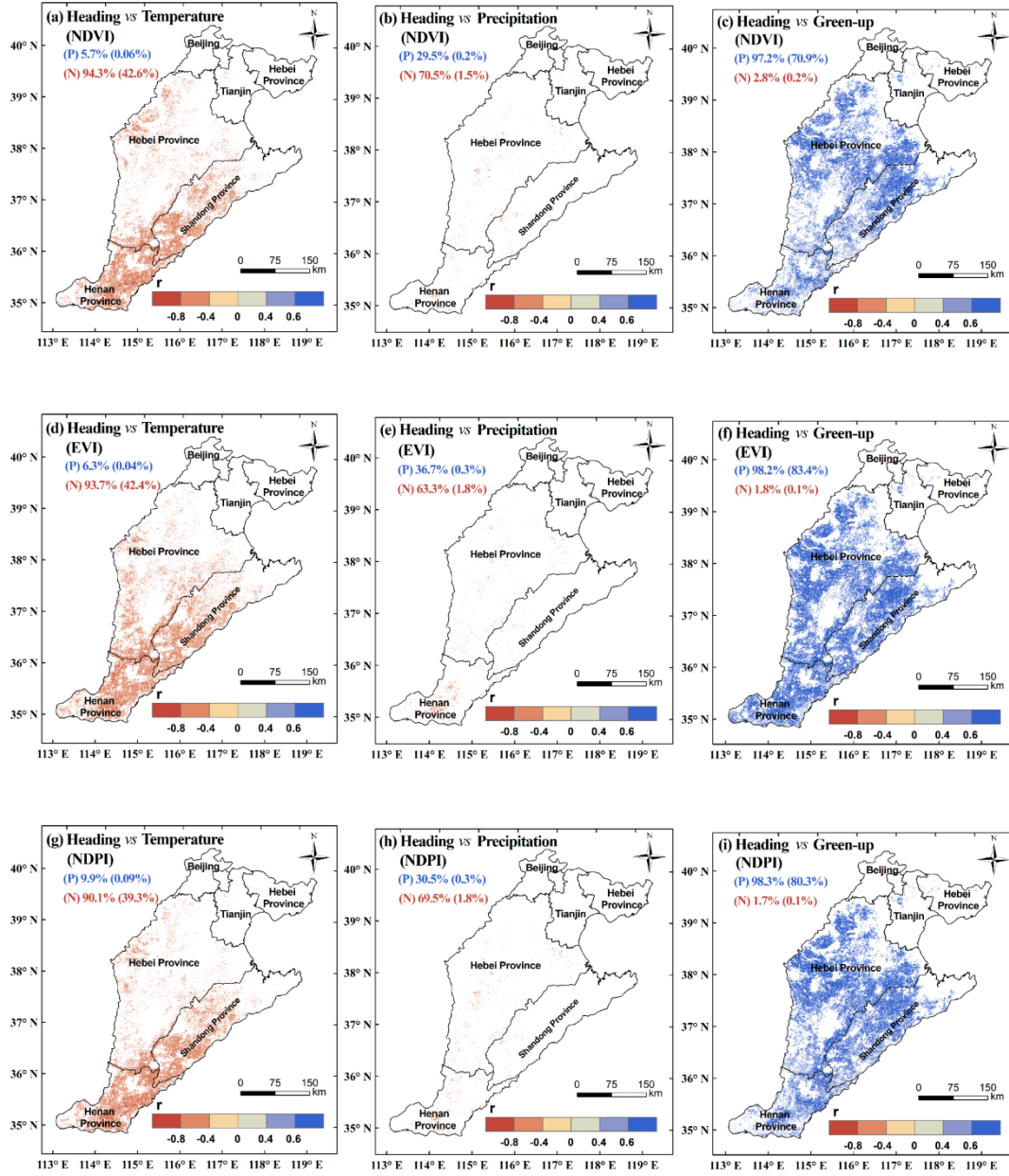


Figure S5. Partial correlation coefficient between heading date of winter wheat derived from NDVI (a-c), EVI (d-f), NDPI (g-i) and the mean temperature, the cumulative precipitation during March and April and green-up date of winter wheat. Dotted regions indicated the detected correlation was significant at $p < 0.05$. (P) refers to the positive correlation, (N) refers to the negative correlation.

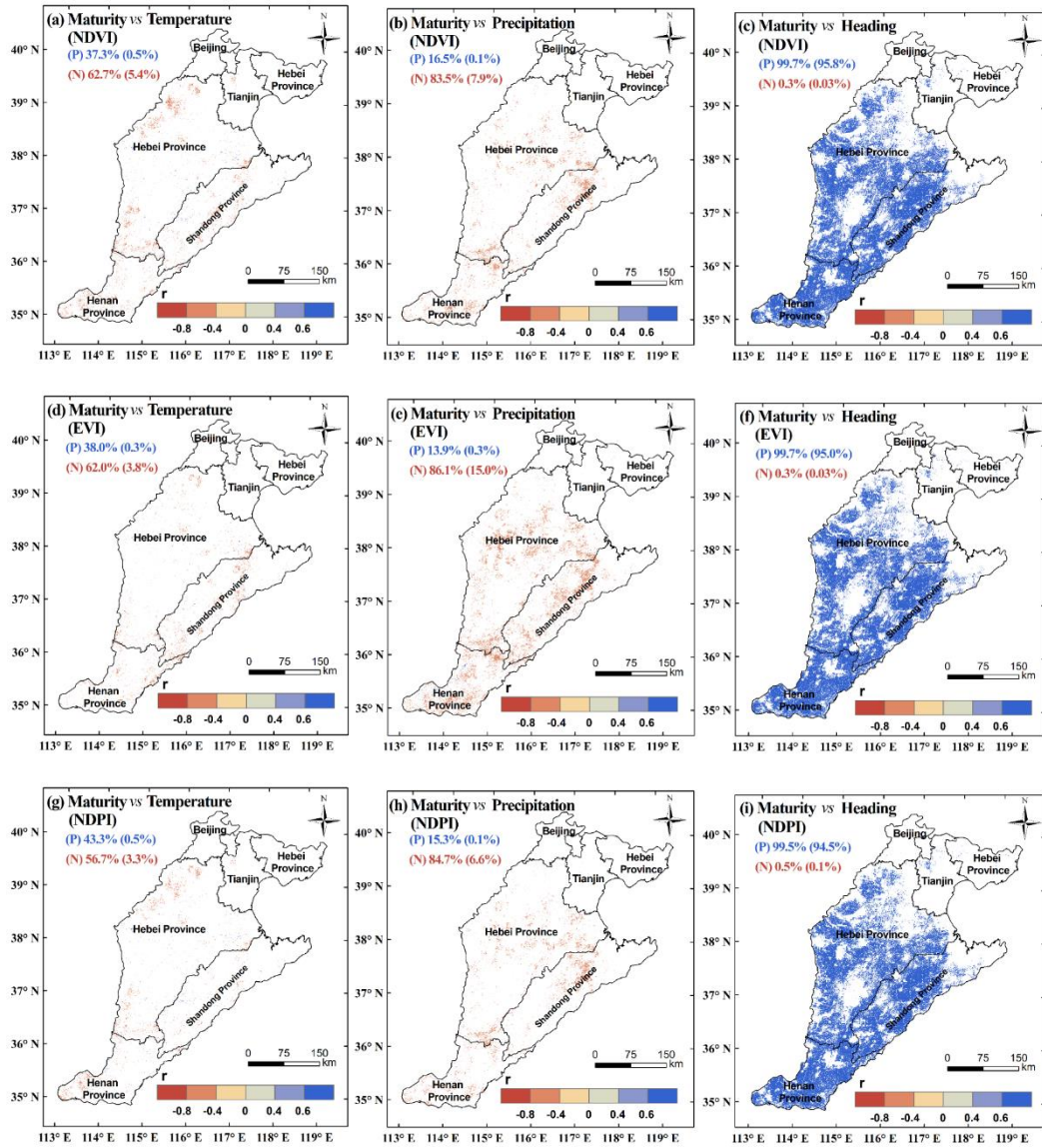


Figure S6. Partial correlation coefficient between maturity date of winter wheat derived from NDVI (a-c), EVI (d-f), NDPI (g-i) and the mean temperature and the cumulative precipitation during April and May, green-up date of winter wheat. Dotted regions indicated the detected correlation was significant at $p < 0.05$. (P) refers to the positive correlation, (N) refers to the negative correlation.

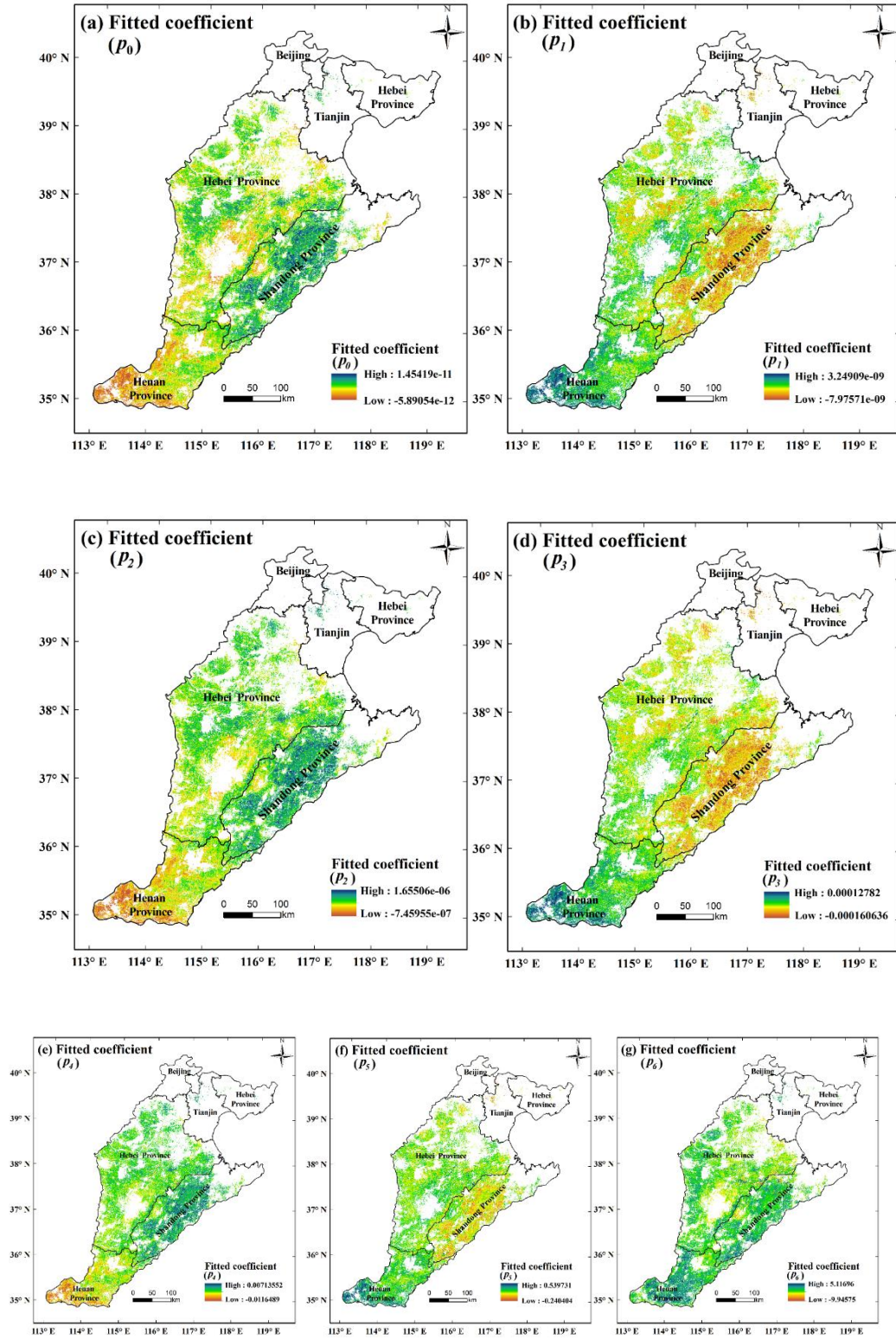


Figure S7. An example of the calculated fitted coefficients through sixth-degree polynomial function ($y = p_0 + p_1x + p_2x^2 + p_3x^3 + \dots + p_6x^6$) based on time series of STSG NDGI in 2013.