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Relation between Ocean SST Dipoles and Downwind Continental Croplands Assessed for Early Management Using Satellite-based Photosynthesis Models

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Crop-monitoring systems with the unit of carbon-dioxide sequestration for environmental issues related to climate adaptation to global warming have been improved using satellite-based photosynthesis and meteorological conditions. Early management of crop status is desirable for grain production, stockbreeding, and bio-energy providing that the seasonal climate forecasting is sufficiently accurate. Incorrect seasonal forecasting of crop production can damage global social activities if the recognized conditions are unsatisfied. One cause of poor forecasting related to the atmospheric dynamics at the Earth surface, which reflect the energy budget through land surface, especially the oceans and atmosphere. Recognition of the relation between SST anomalies (e.g. ENSO, Atlantic Niño, Indian dipoles, and Ningaloo Niño) and crop production, as expressed precisely by photosynthesis or the sequestrated-carbon rate, is necessary to elucidate the mechanisms related to poor production. Solar radiation, surface air temperature, and water stress all directly affect grain vegetation photosynthesis. All affect stomata opening, which is related to the water balance or definition by the ratio of the Penman potential evaporation and actual transpiration. Regarding stomata, present data and reanalysis data give overestimated values of stomata opening because they are extended from wet models in forests rather than semi-arid regions commonly associated with wheat, maize, and soybean. This study applies a complementary model based on energy conservation for semi-arid zones instead of the conventional Penman–Monteith method. Partitioning of the integrated Net PSN enables precise estimation of crop yields by modifying the semi-closed stomata opening. Partitioning predicts production more accurately using the cropland distribution already classified using satellite data. Seasonal crop forecasting should include near-real-time monitoring using satellite-based process crop models to avoid social difficulties that can derive from uncertain seasonal predictions produced from long-term forecasting.

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Key words: crop production, monitoring, forecasting, SST anomaly, remote sensing