

INTERANNUAL VARIATIONS IN PHILIPPINE RICE AND CORN PRODUCTION UNDER CHANGING CLIMATE

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Abstract: Thirteen years of NDVI data from Terra/MODIS is analyzed concurrently with land surface temperature and precipitation rate data from Terra/MODIS and TRMM, respectively. General locations of large regions planted with rice and corn are identified using the relatively high (250-m) resolution NDVI maps from MODIS that are generated to form a series of 16-day composites for the period 2000 to 2013. Enhancement of the NDVI data was performed to ensure consistency and completeness of each composited data. The physical features depicted by the maps, including the vegetation patterns are shown to be intuitively accurate and agree well with higher-resolution satellite data (e.g. Landsat). Strong negative anomalies in NDVI are observed in 2003, 2005 and 2010 while positive anomalies are observed in 2001, 2008, 2009 and 2012. Strong positive anomaly (> 1.5 K) in LST is observed for 2010 while strong negative anomaly (< -1.5 K) is observed in 2011. Low amount of precipitation (at least 60 mm below average) are received during the dry and summer season of 2003, 2005 and 2010 while more precipitation (more than 60 mm above average) are recorded during the dry and summer season of 2009 and 2011. The amount of precipitation during the wet season shows slight variability with a peak in 2011. The spatial distribution of NDVI is also highly correlated with surface temperature data.

Data on annual volume of production of rain-fed rice and corn have been analyzed for the same thirteen-year period when satellite NDVI data was available. The volume of production (in metric ton, mT) of rain-fed rice in the Philippines is observed to be increasing over the last 13 years with a trend of 123,090 mT/year or about 3.4% per year. However, departures from this positive trend were observed in 2003, 2005 and 2010 with productions declining by as much as 2%, 5% and 10%, respectively, compared to previous years. Over the same 13 year period, the volume of corn production in the Philippines has been observed to be increasing with a trend of 272,551 mT/year or about 4.6% per year. However, departures from this positive trend were observed in 2002, 2005 and 2010 with productions that fell by as much as 4.5%, 3% and 9%, respectively, compared to previous years.

Comparative analyses of satellite with in situ data show good qualitative agreement of interannual changes in NDVI with those of rice and corn production in the regions. An unsupervised classification technique is developed to assess the extent and quality of these crops over the entire country and during the 13-year period using MODIS multispectral and NDVI data. Results of analyses showing interannual variations of rice and corn crop production and their relationships with surface temperature and precipitation over the entire country and in regional areas will be presented.

Keywords: NDVI, MODIS, Vegetation, climate change, agriculture