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## ORIGINAL ARTICLE

# Estimation of gross primary production of irrigated maize using Landsat-8 imagery and Eddy Covariance data



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## KEYWORDS

Carbon flux;  
Remote sensing;  
Eddy covariance;  
Maize crop

**Abstract** A study was conducted to understand the potential of Landsat-8 in the estimation of gross primary production (GPP) and to quantify the productivity of maize crop cultivated under hyper-arid conditions of Saudi Arabia. The GPP of maize crop was estimated by using the Vegetation Photosynthesis Model (VPM) utilizing remote sensing data from Landsat-8 reflectance ( $GPP_{VPM}$ ) as well as the meteorological data provided by Eddy Covariance (EC) system ( $GPP_{EC}$ ), for the period from August to November 2015. Results revealed that the cumulative  $GPP_{EC}$  for the entire growth period of maize crop was  $1871 \text{ g C m}^{-2}$ . However, the cumulative GPP determined as a function of the enhanced vegetation index – EVI ( $GPP_{EVI}$ ) was  $1979 \text{ g C m}^{-2}$ , and that determined as a function of the normalized difference vegetation index – NDVI ( $GPP_{NDVI}$ ) was  $1754 \text{ g C m}^{-2}$ . These results indicated that the  $GPP_{EVI}$  was significantly higher than the  $GPP_{EC}$  ( $R^2 = 0.96$ ,  $P = 0.0241$  and  $RMSE = 12.6\%$ ). While, the  $GPP_{NDVI}$  was significantly lower than the  $GPP_{EC}$  ( $R^2 = 0.93$ ,  $P = 0.0384$  and  $RMSE = 19.7\%$ ). However, the recorded relative error between the  $GPP_{EC}$  and both the  $GPP_{EVI}$  and the  $GPP_{NDVI}$  was  $-6.22\%$  and  $5.76\%$ , respectively. These results demonstrated the potential of the landsat-8 driven VPM model for the estimation of GPP, which is relevant to the productivity and carbon fluxes.

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## 1. Introduction

The gross primary production (GPP) is a critical parameter for carbon cycle and climate research. It is used to quantify the total amount of energy or biomass produced by vegetation through photosynthesis over a unit of time (Pingingtha et al.,

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