

COTTON YIELD ESTIMATION IN UZBEKISTAN INTEGRATING MODIS, LANDSAT ETM+ AND FIELD DATA

G. R. Ruecker ^{a,*}, Z. Shi ^b, M. Mueller ^c, C. Conrad ^a, N. Ibragimov ^d,
J. P. A. Lamers ^c, C. Martius ^c, G. Strunz ^a, S.W. Dech ^a

^a German Remote Sensing Data Center (DFD), German Aerospace Center (DLR), 82234 Wessling, Germany - (gerd.ruecker, christopher.conrad, guenter.strunz, stefan.dech)@dlr.de

^b Institute of Agricultural Remote Sensing and Information System, Zhejiang University, Hangzhou 310029, China - shizhou@zju.edu.cn

^c Center for Development Research (ZEF), University of Bonn, Walter-Flex-Str. 3, 53113 Bonn, Germany - (marc.mueller, c.martius, jlamers)@uni-bonn.de

^d Uzbekistan National Cotton Growing Research Institute, Tashkent, Uzbekistan - nazar@zef.uzpak.uz

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ABSTRACT:

Estimating crop yields is critical for regions in the Aral Sea Basin, where agriculture, predominantly cotton (*Gossypium hirsutum* L.) production, is the main source of income. Monitoring the spatial distribution of cotton yields helps identifying sites with yield constraints, so that appropriate counteractions such as the application of targeted agricultural inputs or land use restructuring can be taken. An agro-meteorological model evolved from Monteith's biomass production model was developed for estimating spatially distributed cotton yield in Uzbekistan using multi-temporal MODIS-derived parameters from 2002 as primary data inputs. Local meteorological data was used for estimating the photosynthetically active radiation (PAR) and the environmental stress scalars, including air temperature stress and vapor pressure deficit stress on crop development. High spatial resolution Landsat 7 ETM+ images were applied to extract the area under cotton cultivation within the landscape and to determine the cotton fraction among other land uses within the coarse spatial resolution MODIS pixels. The spatial resolution of the MODIS FPAR data was upgraded by using an established relationship to the higher resolution MODIS NDVI data. The estimated raw cotton yield reached an average of 2.38 t ha⁻¹ and ranged from 1.09 to 3.76 t ha⁻¹. The pixel-based modeling revealed a general spatial trend of higher yield in upstream areas and in locations closer to the irrigation channels and lower yields in downstream area and sites more distant to irrigation channels. The validated yield estimations showed a ca. 10 % deviation from official governmental statistics at district level. The established agro-meteorological model with minimum data input, and mainly based on multi-temporal, freely available MODIS data is a promising strategy for economic and operational late season estimation of spatially distributed cotton yield over large regions.

* Corresponding author.