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Monitoring of spatiotemporal patterns of Net and Gross Primary Productivity (NPP & GPP) and their ratios (NPP/GPP) derived from MODIS data: assessment natural drivers and their effects on NDVI anomalies in arid and semi-arid zones of Central Asia.

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Abstract.

Previous studies have shown that precipitation anomalies and raising of temperature trends were deteriorate affected on large-scale of vegetation surveys in Central Asia (CA). Nowadays, remote sensing techniques can provide estimation of Net and Gross Primary Productivity (NPP & GPP) for regional and global scales, and selected zones in CA (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan) dominated by C_4 plants (biomes) what it reveals more accurately simulate C_4 carbon. The estimation of NPP & GPP from source (MOD17A2/A3) would be beneficial to determine natural driver factors, whether on rangeland ecosystem is a carbon *sink* or *source*, such as a vast area of the selected zones incorporates exacerbate regional drought-risk factors nowadays. Generally, we have combined last available NPP & GPP (2000-2015) with 1 km resolution from MODIS, with investigation of long-term vegetation patterns under Normalized Difference Vegetation Indices (NDVI) with 8 km resolution from AVHRR-GIMMS 3g sources (2001-2015) within aim to estimate potential values of rangeland ecosystems. Interaction ratios of NPP/GPP are integrating more accurately describe carbon sink process under natural or anthropogenic factors, specifically last results of NDVI trends were described as decreasing trends due to climate anomalies, besides the eastern and northern parts of CA (mostly boreal forest zones) where accumulated or indicated of raising trends of NDVI in last three years (2012-2015).

Results revealed that, in CA were averaged annually value NDVI ranges from 0.19-0.21; (Kyrgyzstan: 0.23-0.26; Kazakhstan: 0.21-0.24; Tajikistan: 0.19-0.21); and resting countries as low NDVI accumulated areas were Turkmenistan and Uzbekistan ranges 0.13-0.16;

Comparing datasets of GPP given the response dynamic change structures of NDVI values and explicit carbon uptake (CO_2) in arid ecosystems and average GPP_{yearly}in CA ranges 2.42 kg C/m^2; including to Tajikistan, Uzbekistan (3.09 kg C/m^2) and Turkmenistan (3.59 kg C/m^2); Kazakhstan and Kyrgyzstan 0.88 & 1.46 kg C /m^2. The ratings of dynamical GPP & NPP were similar for each 5 years (2000-2005, 2005-2010 and 2010-2015) and ranges GPP $\approx$ 2.42 kg C/m^2 and NPP $\approx$ 2.36 kg C/m^2. NPP is more accuracy in desert zones, basically, the bare areas shown a high values.

The results shown that meanwhile values of NPP/GPP is relatively illustrated same results as NDVI annual trends, and NPP/GPP average value of 1.03, and incorporating well for sparsely vegetated ecosystems of CA. MODIS derived primary production datasets could improve a better estimate ecosystem process and vegetation/carbon change anomalies during water-stressed conditions in the regional level.