TECHNISCHE UNIVERSITÄT DRESDEN

Faculty of Environmental Science, Department of Geosciences

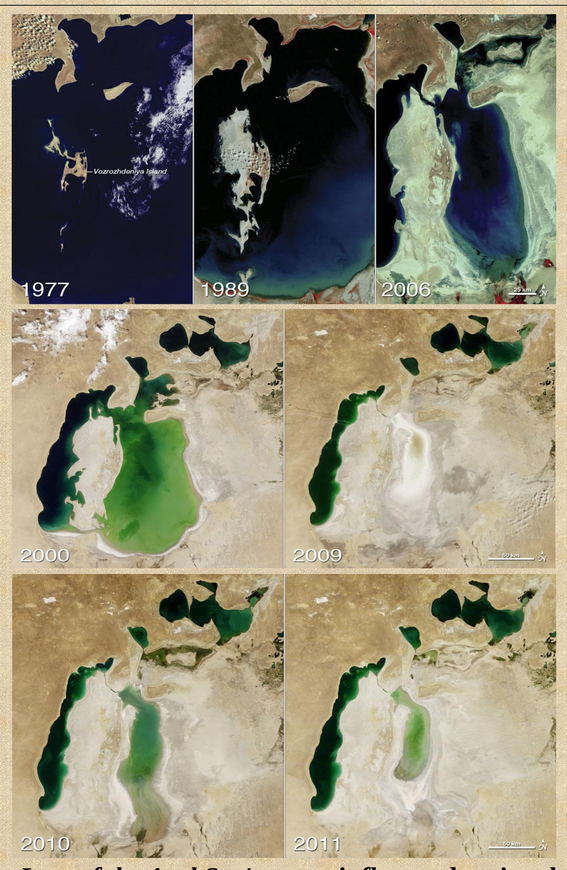
Impacts of climate anomalies on the vegetation patterns in the arid and semi-arid zones of Uzbekistan

Introduction

Steadily raising the temperature anomalies in last decades are affecting the slightly changes of vegetation patterns and the plant ecosystem is sensitive to climate change anomalies and responses of landscape scale of vegetation changes in the arid and semi-arid dryland ecosystems. The regional losses each year just from salinization have been estimated to be at least *$2 billion*, or about 5% of the region's GDP *(WB, 2002*). Mismanagement of this valuable Aral Sea ecosystems by the overuse of its tributary rivers is now recognized as one of the world's worst environmental disasters.

Actual topic

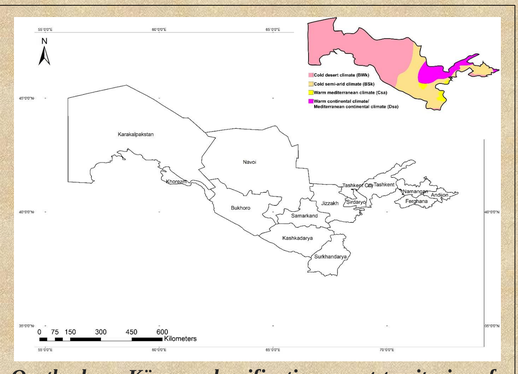
After desiccation Aral Sea Basin, Uzbekistan has a main potential to develop and subsequent launch of drought and heat stress monitoring system (with related vegetation status and fire or damages in agriculture) and constantly verifying through remote sensing tools. Therefore, this study examines to extract and utilize approaches what integrated to apply for assessment vegetation cover especially in the problem of soil salinity and desertification factors in the drylands



Loss of the Aral Sea's water influenced regional climate, making the winters even colder and the summers much hotter. **Credit: NASA**

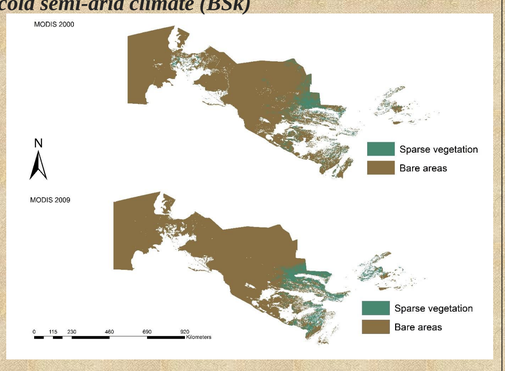
Target area *(41.3775° N, 64.5853° E)*

***U*zbekistan is located in the continent of Asia, the areas most affected by land degradation are concentrated in the middle and lower reaches of the Amu Darya River. Classification of Köppen given the clear idea of temporal vegetation anomalies syndrome during precipitation anomalies period.**



On the base Köppen classification, most territories of Uzbekistan is situated cold desert climate (BWk) & cold semi-arid climate (BSk)

Hot period of summer due to low precipitation and high evapotranspiration is exposed to dryness of soil and mostly desert vegetation, especially semi-shrubs and shrubs lose their leaves to reduce evapotranspiration and this period accumulated less NDVI index, and determined as a low values of vegetation.



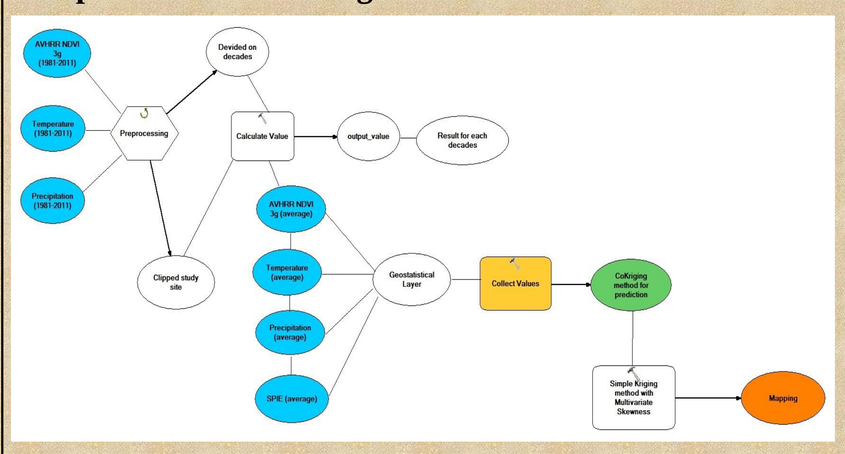
MODIS (2000&2009) described change detection of sparse vegetation on the north-eastern part of Uzbekistan

Key statistics about Uzbekistan (FAO,2013)

Country area	Land area	Agricultural area	Forest area
44740 (1000 Ha)	42540 (1000 Ha)	26770 (1000 Ha)	3242.14 (1000 Ha)

Methods

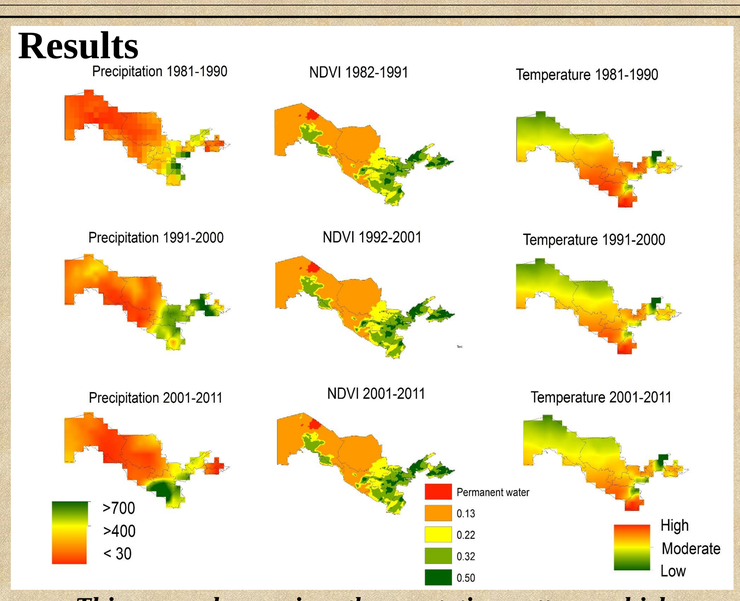
The assessment based on application of satellite images (NDVI3g & MODIS) has developed with statistical calculation and applied geo-statistical methods (CoKriging) with variograms to detect degradation areas and predict of further vegetation status.



Flowchart of the methodology used for time series analysis

It is challenge to extract the desert vegetation information from satellite images because of the influence low values of vegetation due to low precipitation of the background.

Results

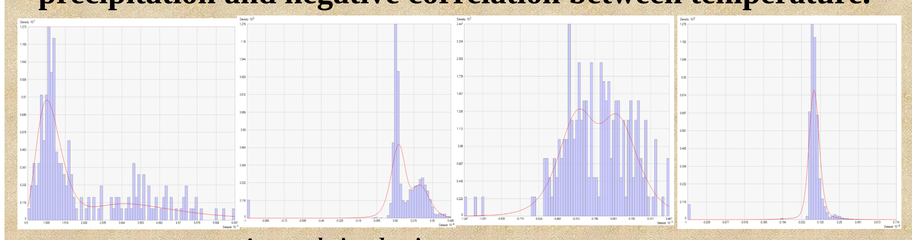


This research examines the vegetation patterns which identified and characterized the impacts of climate anomalies in the last three decades (1982-2011).

The regions where the annual NDVI decreased were mainly distributed in western part and central part of Uzbekistan, which may be caused by the decreased precipitation and influence of salt movement from Aral Sea.

Geo statistical analysis_Multiplicative Skewness

Climate drivers and dynamics of vegetation associated with a time series of analysis what shown positive correlation between precipitation and negative correlation between temperature.

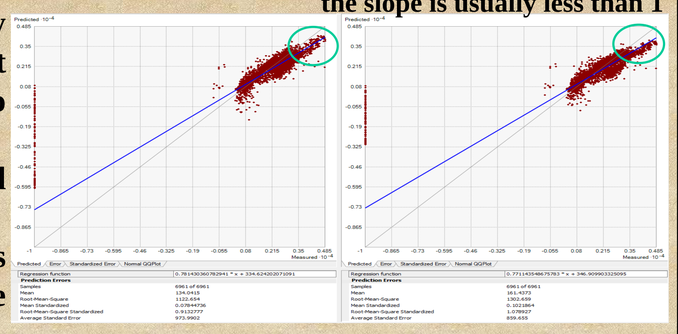


Accumulation of precipitation | *Accumulation density of NDVI values* | *Temperature datasets* | *SPIE datasets*

Cross validation factors to compare prediction data

the slope is usually less than 1

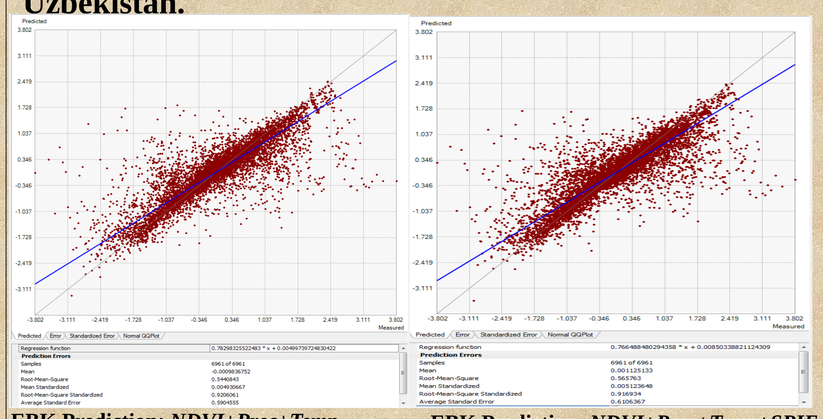
It is a property of kriging that tends to underpredict large values and overpredict small values, as shown in the following figure:



Prediction:NDVI+Prec+Temp | *Prediction:NDVI+Prec+Temp+SPEI*

Prediction Map about vegetation status

Bi-weekly Normalized Difference Vegetation Indices (1982-2012) calculated with several climate parameters with geostatistical method to predict vegetation status of forthcoming years due to scarcity of water resources in Uzbekistan.



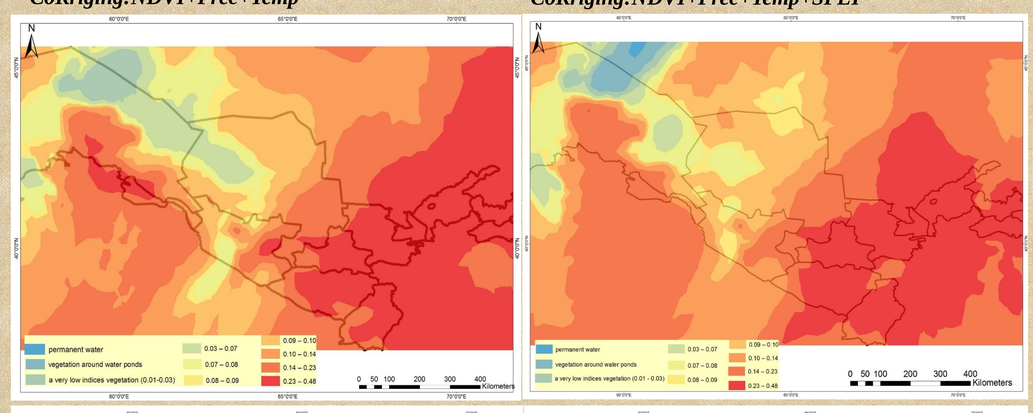
EBK Prediction: *NDVI+Prec+Temp*

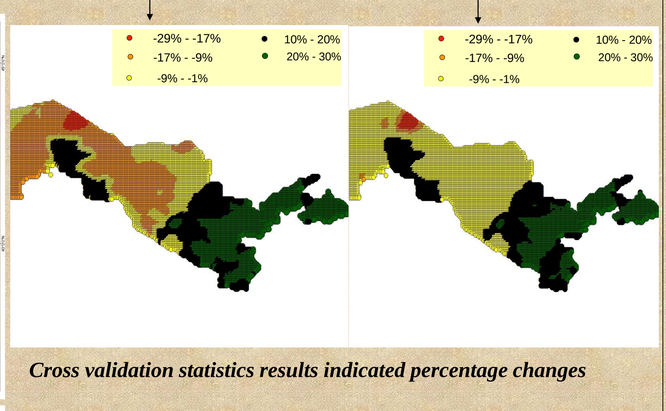
EBK Prediction: *NDVI+Prec+Temp+SPIE*

Emperical Bayesian kriging (EBK)-process implicitly assumes that the estimates semivariogram is the true semivariogram for the interpolation region.

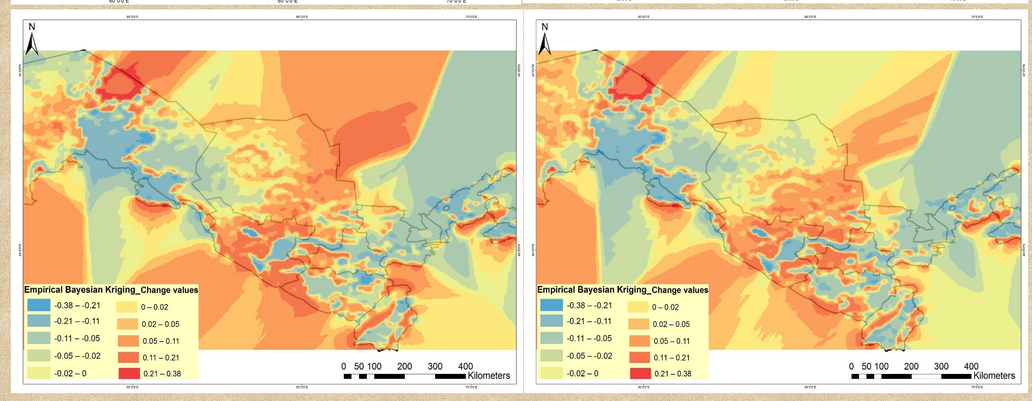
CoKriging:NDVI+Prec+Temp

CoKriging:NDVI+Prec+Temp+SPEI





Cross validation statistics results indicated percentage changes



EBK:NDVI+Prec+Temp | *EBK:NDVI+Prec+Temp+SPEI*

Vegetation successions in response to climate anomalies and within observing transect changes of vegetation in this region given the idea to analyze irreversible landscape changes and measuring the impacts of anthropogenic causes in the semi-arid rangelands.

Acknowledgement

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