Extreme weather conditions in the summer season derived from direct and indirect measurements in Southwestern Danube Plain

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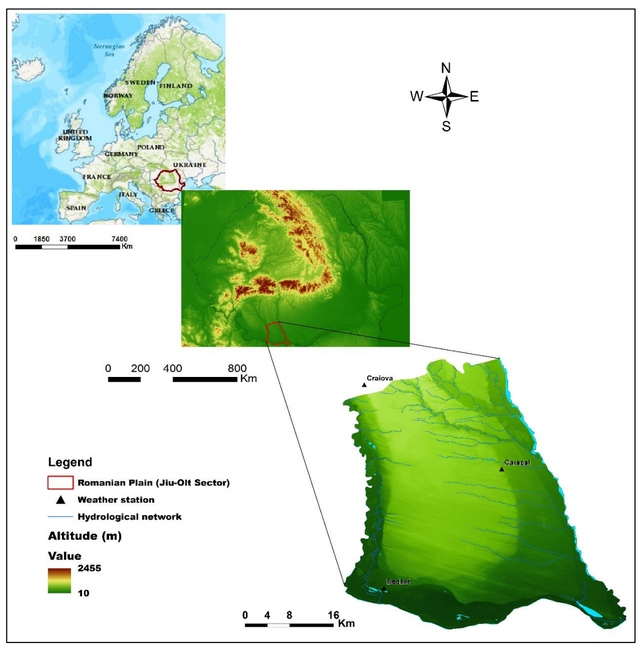
Introduction

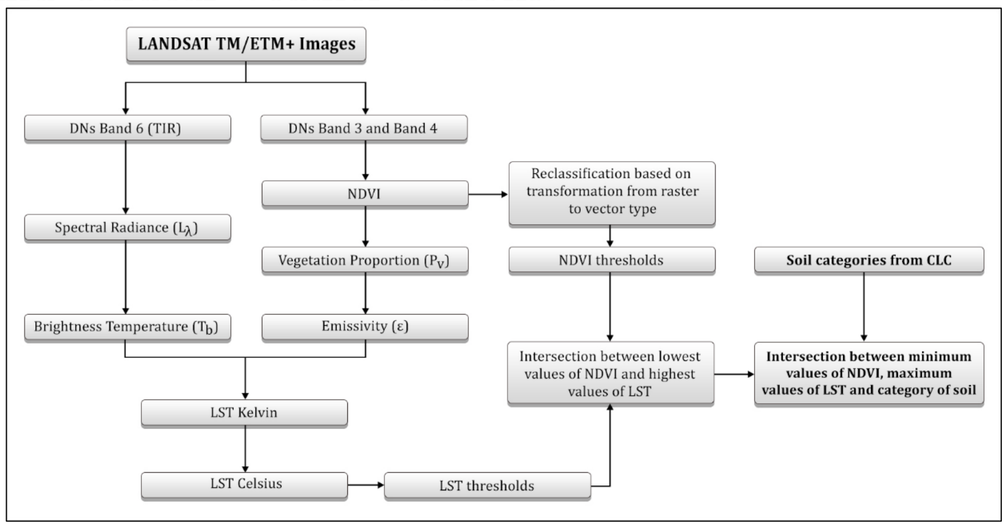
The main aims of this study are to characterize the Southwestern Danube Plain in the summer season by remote sensing and climatic data as well as to explore the relationships between different remote sensing derived indices under extreme weather conditions.



Location of study area

Data and methods

Sixteen satellite images of Landsat missions (got by TM, ETM+ and OLI_TIRS sensors), covering a 30-years period (1986-2015) were used to calculate three remote sensing derived indices: Land Surface Temperature, Normalized Difference Vegetation Index, and Normalized Difference Moisture Index. Climatic data used in this study consists of daily maximum air temperature, ground level temperature, and precipitation, recorded in Bechet and Caracal weather stations.



Algorithm for satellite data processing (Rosca et. al., 2016)

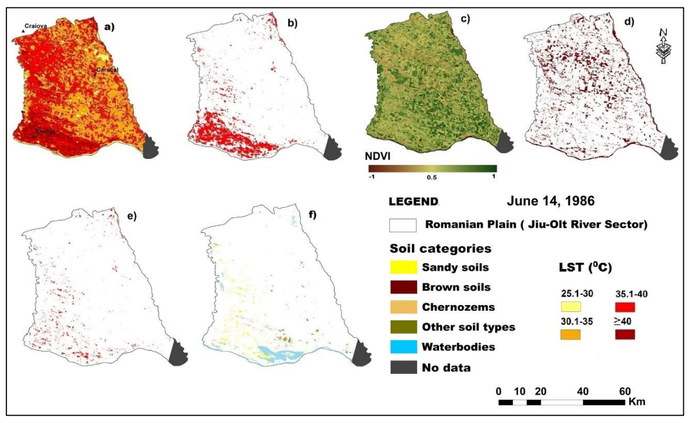
Conclusion

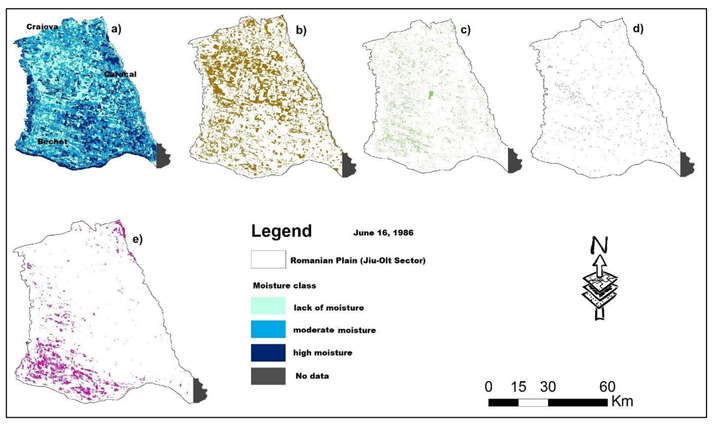
In the Southwestern Danube Plain, the atmospheric drought represent a major environmental problem related to the summer season. Moderate density vegetation class obtained from, represented by cultivated areas, has proved to be highly affected by equal to or higher than 40.0°C. The entire territory is affected by higher temperatures in summer season, and the satellite images derived indices proved to be the most reliable to highlight the heat waves impact on humidity and vegetation. Under these circumstances, local and central authorities should adopt the most appropriate measures in order to avoid the negative impact of such events.

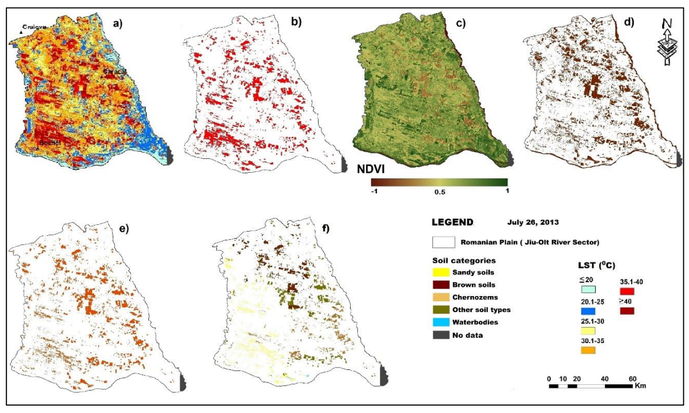
Results

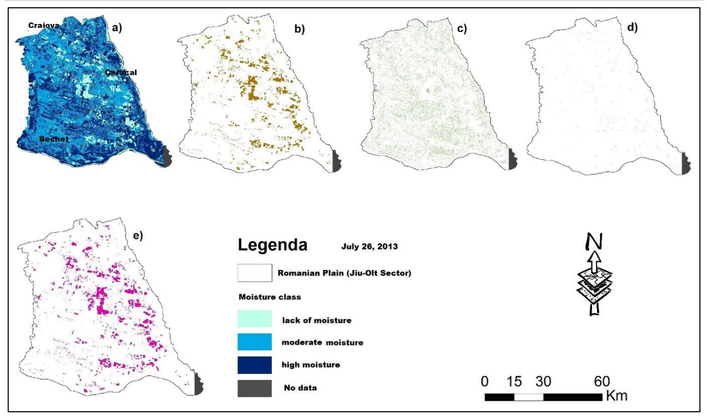
Visual analysis

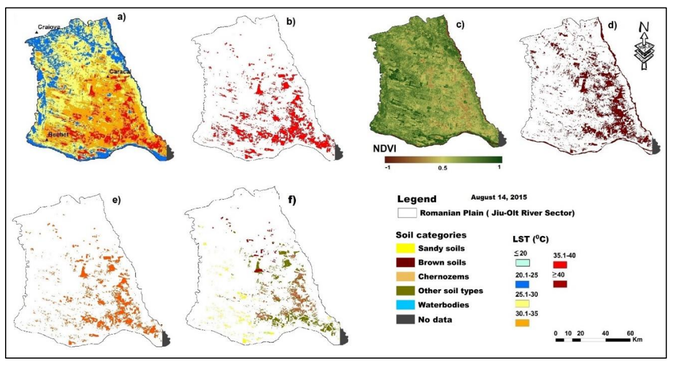
Climatic conditions in recent years have been unfavorable for most crops, because of high stress generated by high temperature and water scarcity during growing season.



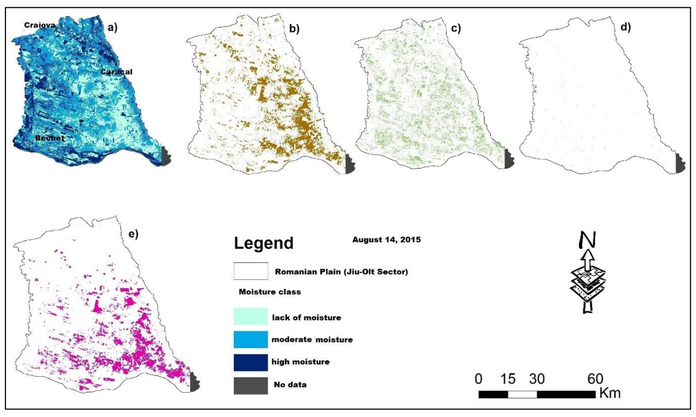








LST, NDVI, and soil types (a LST; b polygons with LST ≥ 40.0 °C (%); c NDVI; d polygons with lack of vegetation; e polygons with intersection between lack of vegetation and LST ≥ 40.0 °C; f polygons with intersection of (e) and soil categories)



NDMI, NDVI, LST (a. NDMI; b. polygon with intersection between lack of moisture and lack of vegetation; c. intersection between lack of moisture and moderate vegetation class; d. intersection between lack of moisture and healthy vegetation class; e. intersection between lack of moinsture and LST ≥ 40,0 °C)

Quantitative analysis

The results showed than Land Surface Temperature and Normalized Difference Vegetation Index correlate stronger (r=0.95) than NDMI and NDVI (r=0.84) suggesting that temperatures equal to or higher than 40 °C play an important role to lack of vegetation than low or lack of soil moisture.

LST and areas without vegetation detected from satellite image and ground temperature recorded in Caracal Weather Station

Date	Time of satellite image	LST (°C)	Area without vegetation (%)	Area with LST≥40.0 °C (%)	Interval of measurement	Ground temperature in Caracal (°C)	
						T mean	Tmax
06/14/1986	08:29:46	25.9	15.6	9.94	00:06-18:00	26.0	38.6
26/07/2013	09:11:18	37.8	19.4	13.4	00:06-18:00	30.7	40.0
14/08/2015	09:09:22	33.2	19.0	15.2	00:06-18:00	27.5	35.0

Areas of polygons with LST equal to or higher than 40.0 °C, low vegetation cover, and soil types (%)

Soil Type	Area covered (%)	14 June, 1986	26 July, 2013	14 August, 2015
Sandy soils	*51.8*	*4.1*	*8.9*	*4.3*
Brown soils	*18.5*	*0.1*	*12.8*	*3.1*
Chernozems	*15.2*	*1.7*	*10.5*	*19.3*
Other soil types	*11.4*	*2.1*	*29.1*	*27.6*
Waterbodies	*3.1*	*2*	*2.6*	*1.7*

Weather variables and affected areas (%)

Variable	14 June, 1986	26 July, 2013	14 August, 2015
Daily precipitation data (Caracal weather station) (mm)	0.2	0.0	0.0
Relative humidity (Caracal weather station) (%)	82.0	50.3	37.0
Area without moisture (%)	32.2	28.3	29.6
polygon with intersection between lack of moisture and lack of vegetation (%)	25.2	8.3	15.7
intersection between lack of moisture and moderate vegetation class (%)	6.4	10.0	14.0
intersection between lack of moisture and healthy vegetation class (%)	0.1	0.2	0.1
intersection between lack of moinsture and LST ≥ 40,0 °C (%)	5.6	7.2	12.1

Acknowledgment

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