Extreme Precipitation and Temperature Events in Georgia Using Regional Climate Model

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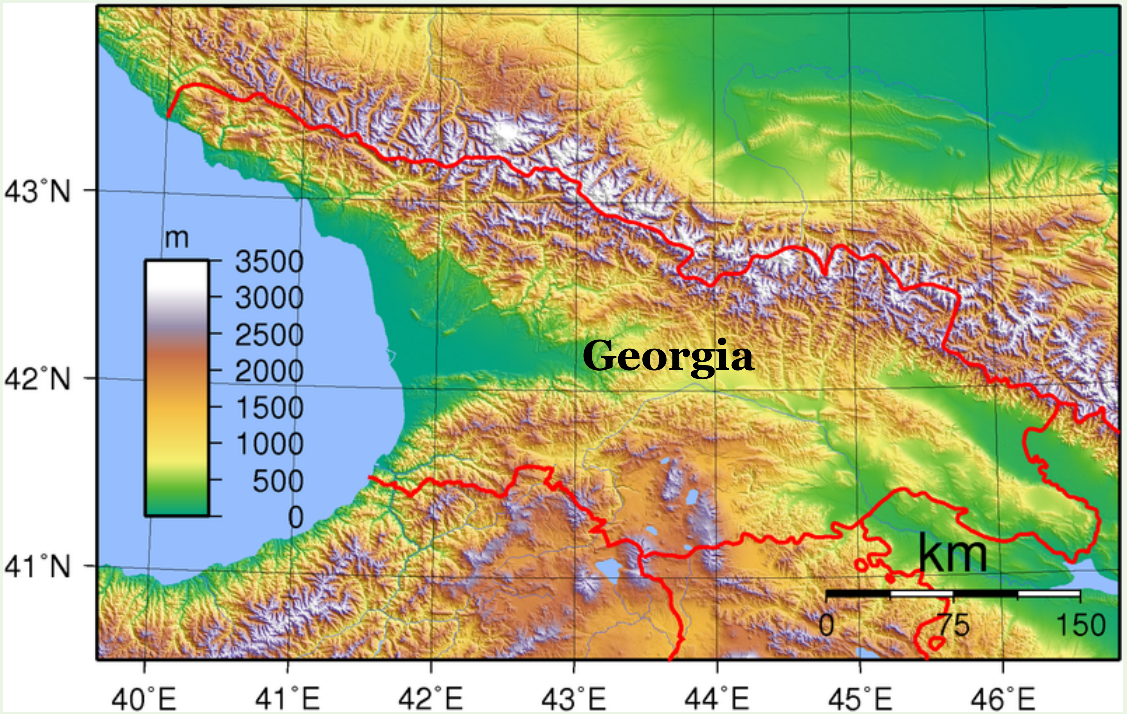
Topography of Georgia. Solid red lines depict political boundaries



area - 67,900 km^2

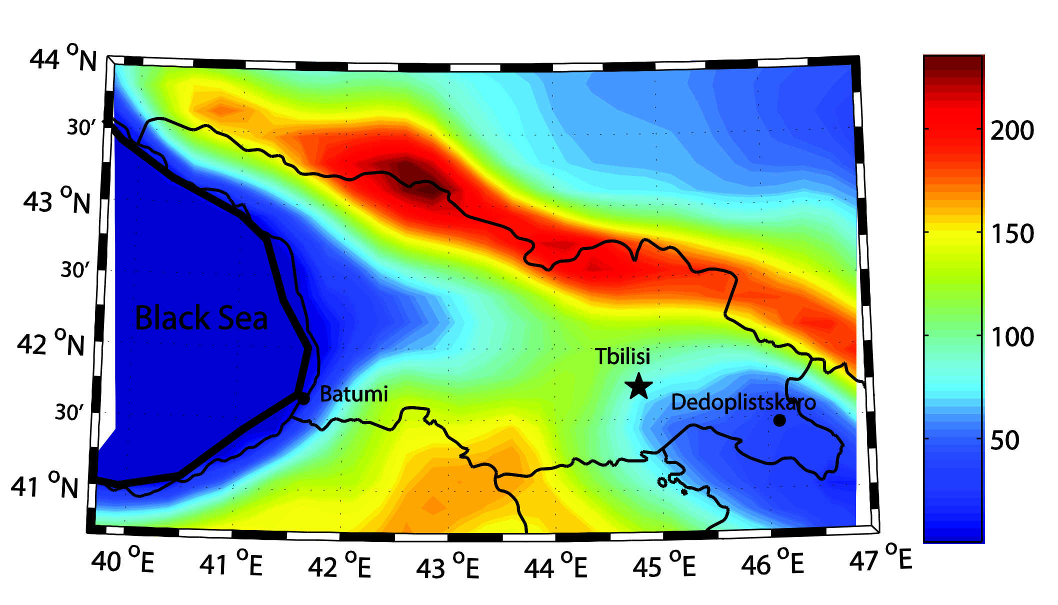
Along the Black Sea coast is dominant high humidity and heavy precipitation (1,000 to 2,000 mm per year), the midwinter average temperature is 5 °C and the midsummer average is 22 °C. The plains of eastern Georgia are characterized with a more continental climate, average summer temperatures 20 °C to 24 °C, winter temperatures 2 °C to 4 °C, low humidity, and rainfall averages 500 to 800 mm per year. At higher elevations, precipitation is sometimes twice as heavy as in the eastern plains. In the west, the climate is subtropical to about 650 m; above that altitude is a band of moist and moderately warm weather, then a band of cool and wet conditions. Alpine conditions begin at about 2,100 m, and above 3,600 m snow and ice are present year-round.

- **RegCM4.1.**
- **For model simulation the minimum allowable horizontal resolution of 20 km was used.**
- **A model run has been carried out using reanalysis data - ERAinterim for the 1989 - 2008, time period.**
- **For a sea surface temperature (SST) the optimum interpolation of sea surface temperature (OISST) was used, which is available weekly on a 1.0° x 1.0° grid.**

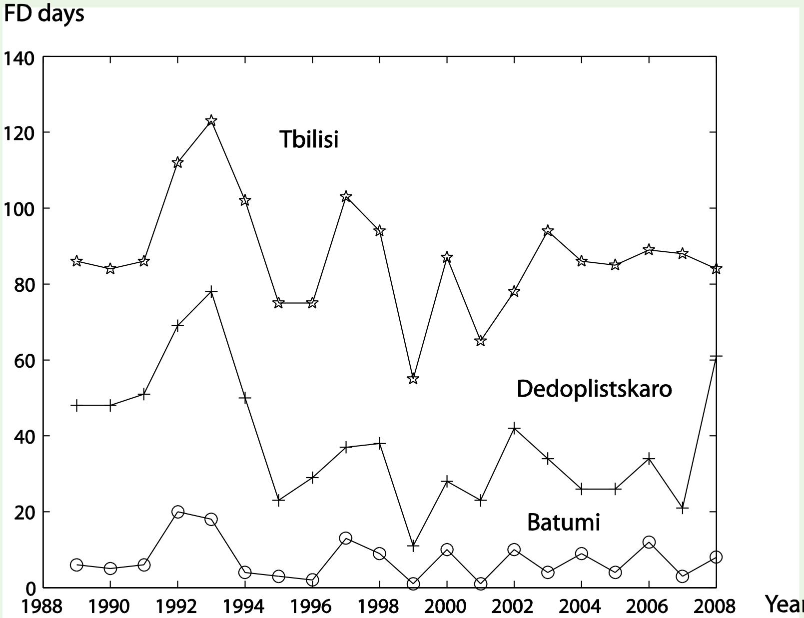
Abbreviation and definition of the indices

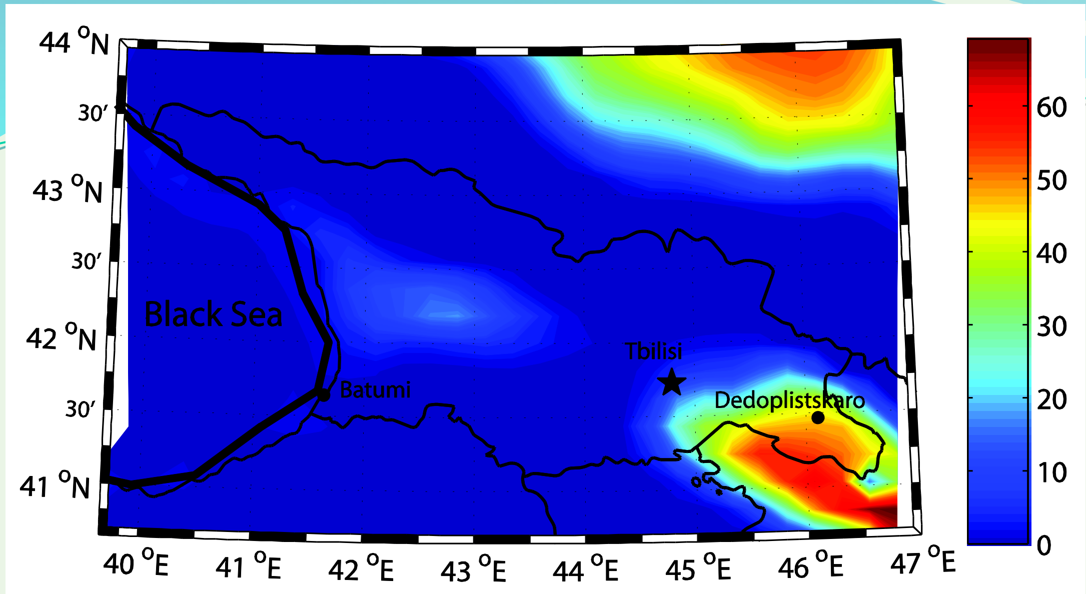
Variable	Abbreviation (unit)	Definition of extreme indices
Temperature	FD (days)	Number of frost days (with *T* min below 0°)
	HD (days)	Number of hot days (with *T* max above 30°)
	HW (days)	Maximum duration of consecutive hot days
Precipitation	PN80 (days)	Number of days with precipitation above 80 mm intensity
	PX1D (mm)	Greatest 1-day total precipitation
	MDRY (days)	Maximum duration of consecutive dry days
	MWET (days)	Maximum duration of consecutive wet days

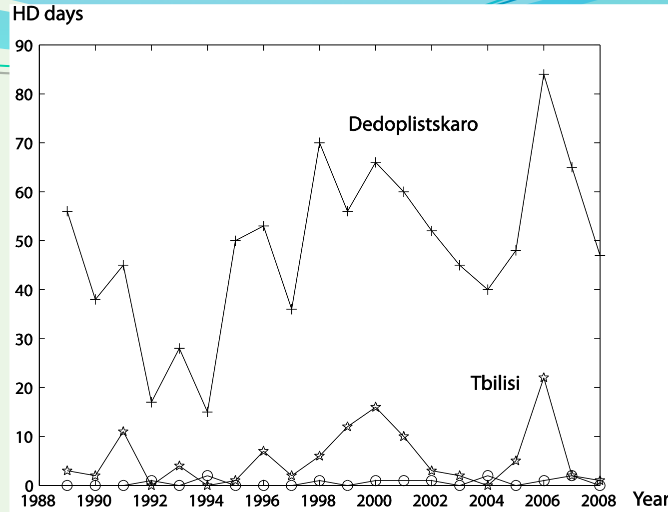
Extreme Temperature Indices



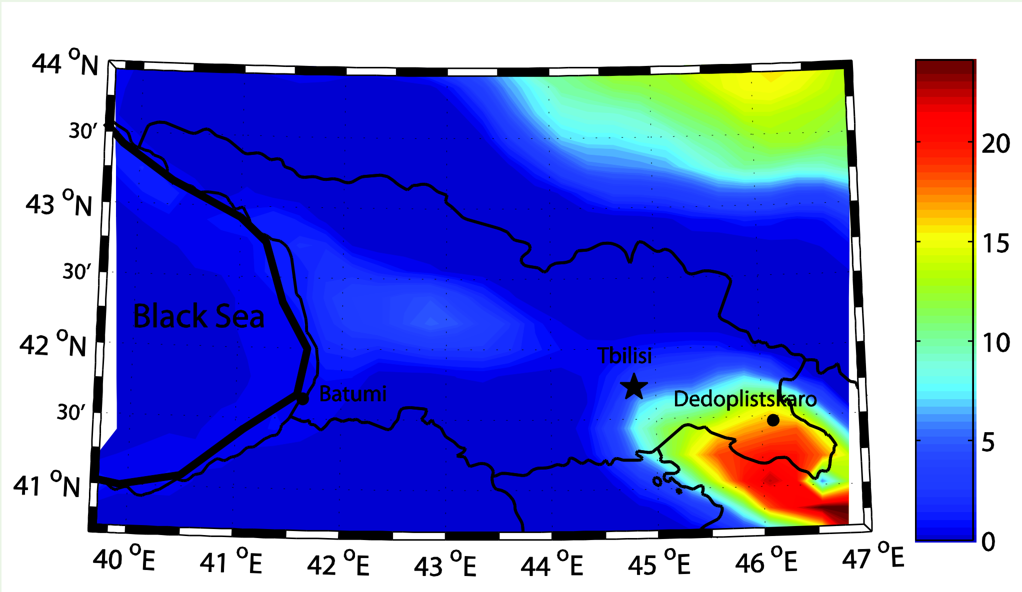
Average number of FDs from 1989-2008.
Star indicates Georgian capital, thin black line depicts country borders, while thick black line shows the coastline.

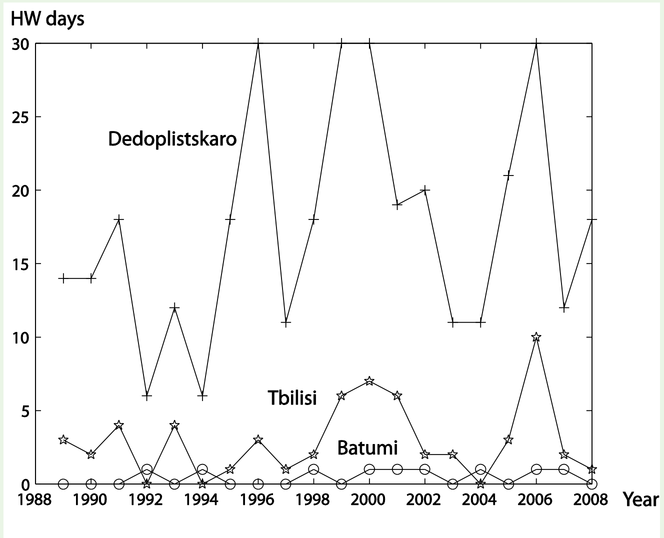






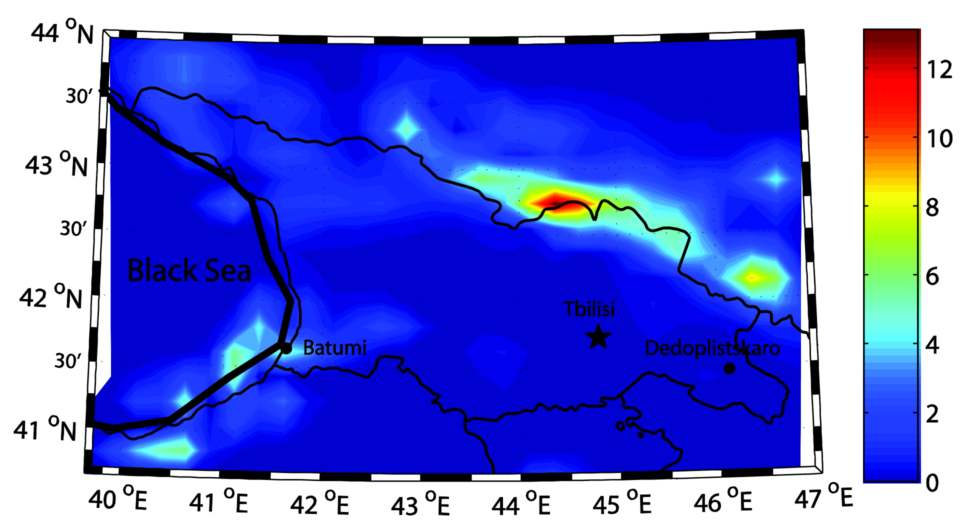
Average number of HDs from 1989-2008



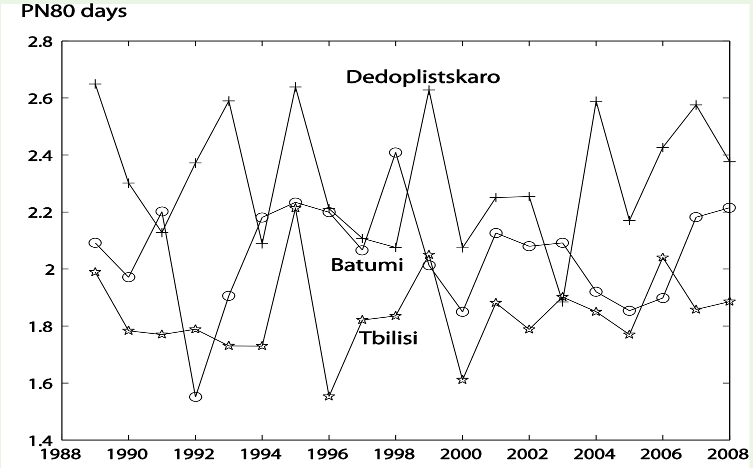


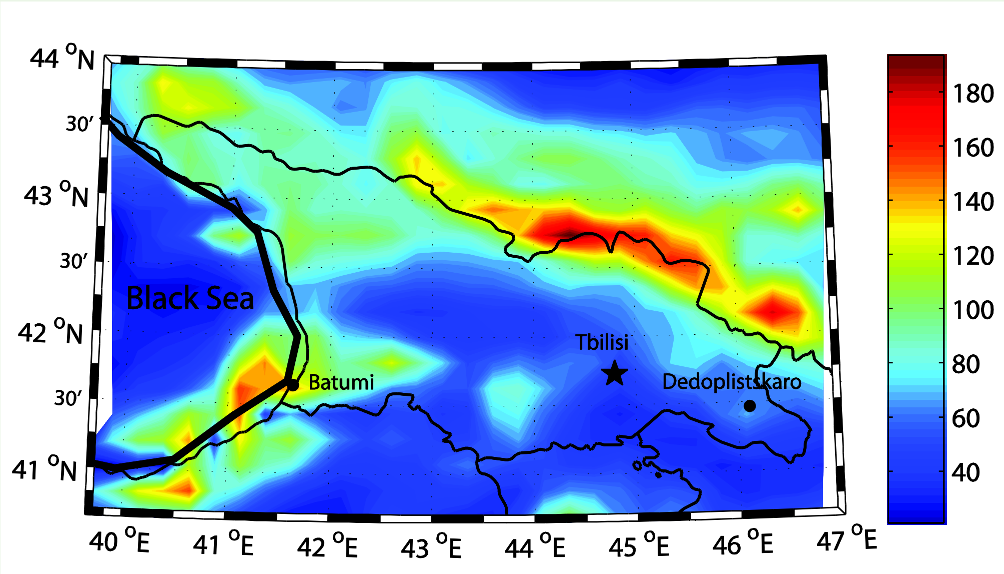
Average number of HWs from 1989-2008

Extreme Precipitation Indices

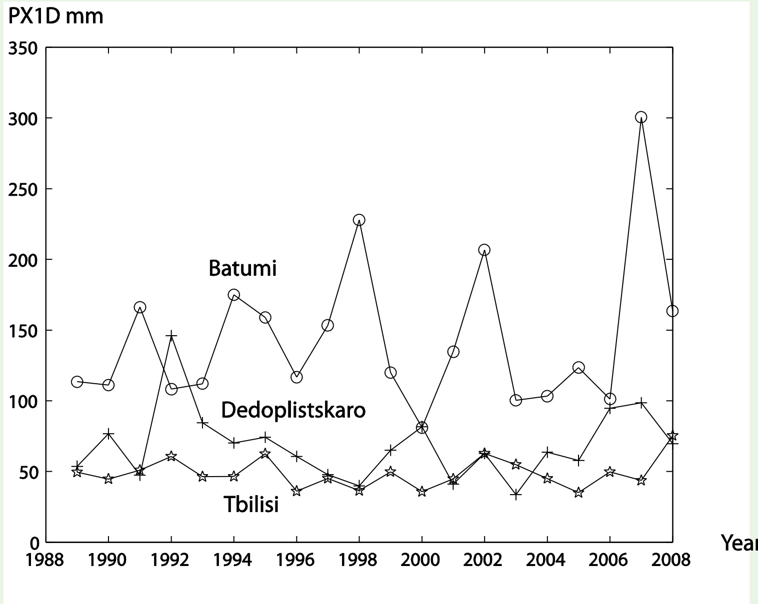


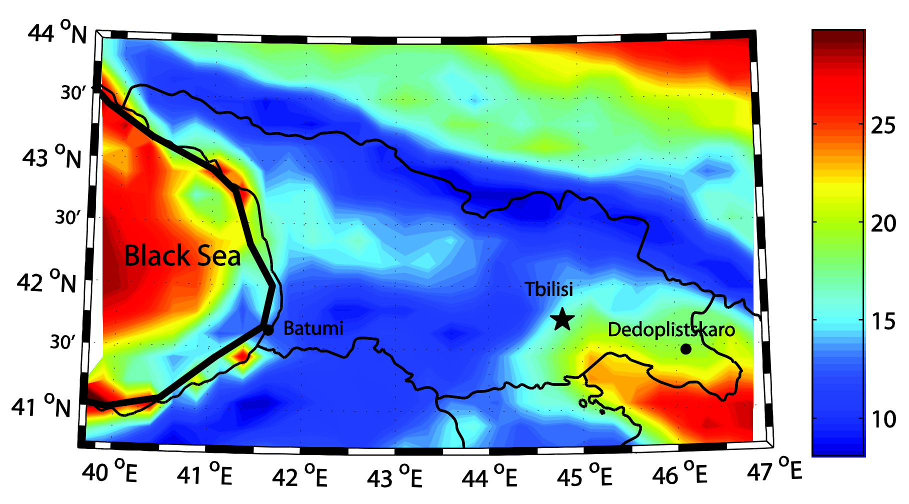
Average number of PN80 from 1989-2008

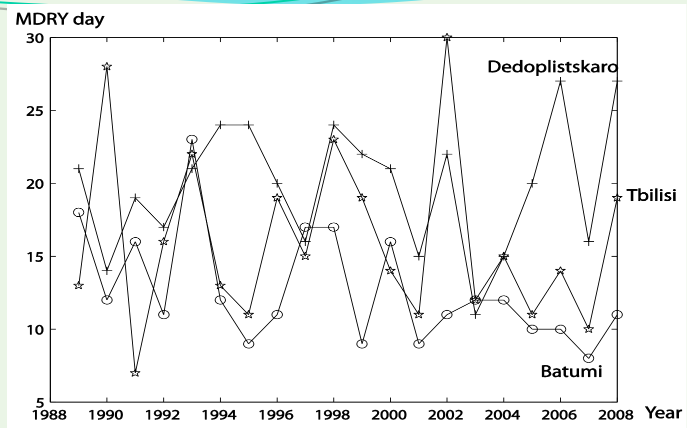




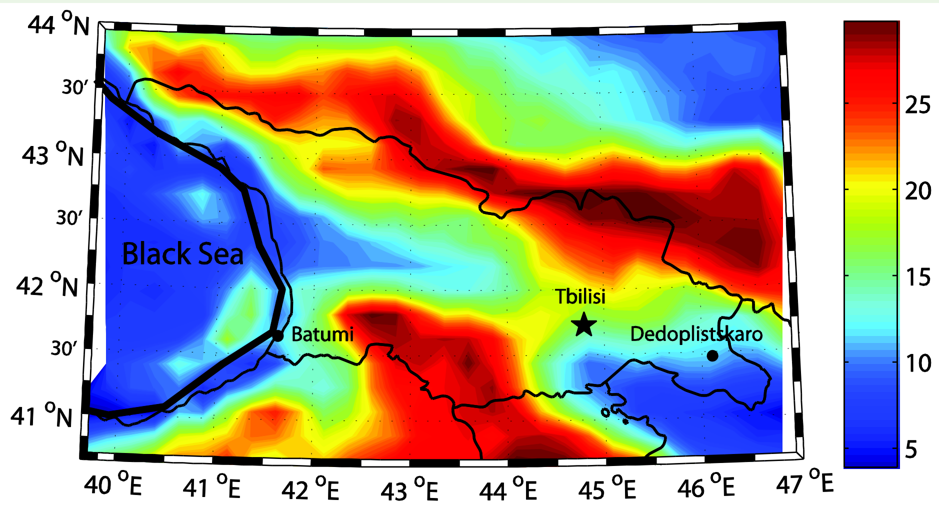
Average PX1D from 1989-2008

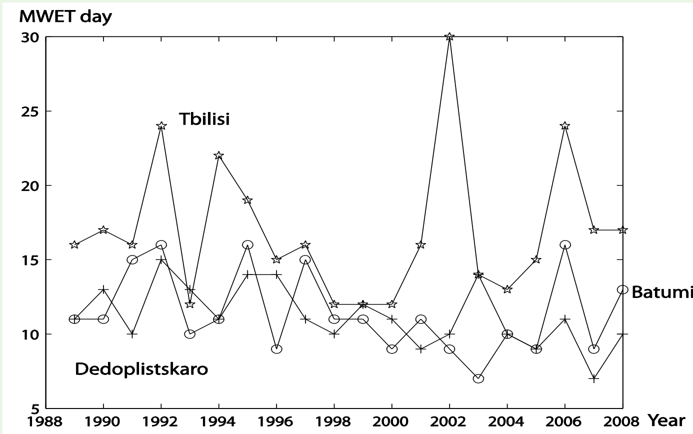






Average number of MDRY from 1989-2008





Average number of MWET from 1989-2008

Statistical Analysis											
City	Variable	Mean	Standard Deviation	City	Variable	Mean	Standard Deviation	City	Variable	Mean	Standard Deviation
Tbilisi	FD	82	15	Dedoplis-tskaro	FD	38	19	Batumi	FD	8	5
	HD	6	5,5		HD	47	17		HD	1,3	1,4
	HW	2,8	2,4		HW	17	8		HW	0,5	0,5
	PN80	1,7	0,1		PN80	2,2	0,2		PN80	2	0,2
	PX1D	48	6		PX1D	66	25		PX1D	137	55
	MDRY	16	6		MDRY	19	4		MDRY	20	4
	MWET	16	5		MWET	11	2		MWET	11	3

Conclusions and Future Work

- The model captures well the influences of the Caucasus Mountains and the Black Sea on distribution of extreme temperature and precipitation events over the Georgian territory.
- The FDs trend is slightly decreasing, while HD, HW trends are slightly increasing for Tbilisi, Dedoplistskaro and Batumi during 1989-2008.
- In the future by using RegCM4 it is possible to investigate the effects of extreme climate and weather events on Georgian Agricultural sector, with particular emphasis on viniculture.
- Changes in frequency of extreme events are caused not only by the global climate change, but also by local effects such as unsustainable population activities leading to the destruction of windbreaks, irrigation systems, land degradation (by overgrazing), mass deforestation as a result of illegal logging. We hypothesize that such local activities are also likely to make considerable contribution to the frequency, duration and intensity of the extreme events. Therefore, from both scientific and policy development point of view it is important to understand what fraction of extreme events can be associated to changing global climate ("external forcing") that most countries have no control over, and what fraction to unsustainable population activities ("internal forcing") that can be resolved with the adoption of proper environmental laws and regulations.
- Black sea level change.


Thank you for attention!