

Extreme changes of temperature and precipitation in three Greek cities

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All extreme weather situations are significantly influenced by climate change, because all weather conditions nowadays are formed into a different environmental than in previous decades. The natural variability of the atmospheric environment, which is important in extreme weather conditions formation, is significantly affected by climate change, obtaining a tendency of more frequent and more intense extreme weather conditions (IPCC, 2012).

Studies carried out in extreme weather situations are of particular interest, because the occurrence of such phenomena and situations can cause considerable economic and human losses, crop destruction and damage to facilities and private property (e.g Dotzek and Forster, 2011, Kober and Tafferner, 2009, Kotroni et al., 2011). The effects of climate change are not the same worldwide. For example, the Eastern Mediterranean (including Greece) has notable signals of vulnerability due to climate changes (e.g IPCC, 2012).

Concerning Greece, several studies have already revealed climate tendencies and anomalies, using different statistical methodologies, time series of data, climate indices and parameters. Characteristically is referred the study of Varfi et al (2009) which revealed an increase in warm days (in absolute values and in frequency of occurrence). In the study of Founda and Giannakopoulos (2009) highlighted the abnormal summer period of 2007 for the southeastern Europe and Balkan peninsula and the positive impact in daily maximum temperature in urbanized environments. In the study of Goubanova and Li (2007), a warmer Mediterranean climate with lower but more intense precipitation is pronounced. Nevertheless, in more recent characteristic study, Karagiannidis et al (2011) was found decreasing trends of extreme cases of precipitation associated with cyclonic behavior in Greece, for the most of the examined cases. While model simulations and the use of satellite datasets can help importantly in climate studies in global and regional scales, the local characteristics of a region can also affect its climatic profile and thus studies that are focusing in specific regions have their own importance.

This study studies the possible tendencies in extreme values of precipitation and air temperature using time series of data provided from the Hellenic National Meteorological Service (HNMS) for the cities of Iraklion, Larisa and Athens (Tatoi station) in Greece.

Regarding air temperature, 3-hourly measurements for over 40 years are used. After extracting the daily maximum values, we use quantitative and empirical criteria adopted from the statistical methodologies handling extreme values to define thresholds about extreme values and perform linear regression models and the non-parametric Kendall-tau

test in the distributions of the extreme values in order to conclude about possible statistical significant trends of the examined parameters for the three examined cities.

Regarding Iraklion city, practically no trend in the extreme values of the air temperature was found but a decrease (non-statistical significant) of the frequency of occurrence, was recorded. The same conclusion was also found for the city of Larisa. Nevertheless, for the station near Athens (Tatoi station) a statistical significant increase about the frequency of occurrence was recorded. For the same station it was also found a statistical significant increase in the extreme precipitation height as well as in the frequency of occurrence. In the other two stations no statistical significant trends about the extreme precipitation were recorded.

Conclusively, the station near the most urbanized environment depicts statistical significant increase in extreme air temperature and precipitation values and their frequency of occurrence, highlighting the possible role of the urbanization in the extreme weather conditions.

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