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Analysis of the synoptic winter mortality climatology in five regions of England: Searching for evidence of weather signals

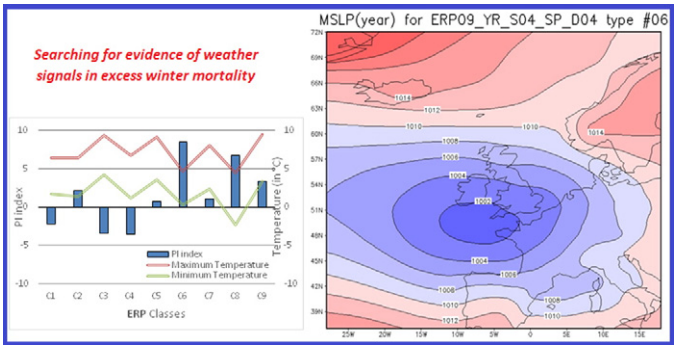
A.K. Paschalidou [a,*], P.A. Kassomenos [b], G.R. McGregor [c]

[a] Department of Forestry and Management of the Environment and Natural Resources, Democritus University of Thrace, GR-68200, Greece
[b] Laboratory of Meteorology, Department of Physics, University of Ioannina, GR-45110, Greece
[c] Department of Geography, Durham University, Durham, United Kingdom

HIGHLIGHTS

- Synoptic circulation patterns are linked to excess cold-related mortality.
- Easterly type of weather appears to be the most unfavorable to public health.
- Spatially homogenous response of mortality to atmospheric patterns is identified.
- Excess winter mortality is generally linked to the lowest daily temperatures.
- Synoptic climatology appears to play a key role in understanding winter mortality.

GRAPHICAL ABSTRACT



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ABSTRACT

Although heat-related mortality has received considerable research attention, the impact of cold weather on public health is less well-developed, probably due to the fact that physiological responses to cold weather can vary substantially among individuals, age groups, diseases etc., depending on a number of behavioral and physiological factors. In the current work we use the classification techniques provided by the COST-733 software to link synoptic circulation patterns with excess cold-related mortality in 5 regions of England. We conclude that, regardless of the classification scheme used, the most hazardous conditions for public health in England are associated with the prevalence of the Easterly type of weather, favoring advection of cold air from continental Europe. It is noteworthy that there has been observed little-to-no regional variation with regards to the classification results among the 5 regions, suggestive of a spatially homogenous response of mortality to the atmospheric patterns identified. In general, the 10 different groupings of days used reveal that excess winter mortality is linked with the lowest daily minimum/maximum temperatures in the area. However it is not uncommon to observe high mortality rates during days with higher, in relative terms, temperatures, when rapidly changing weather results in an increase of mortality. Such a finding confirms the complexity of cold-related mortality and highlights the importance of synoptic climatology in understanding of the phenomenon.

1. Introduction

Extreme weather, in the form of heat waves or cold spells, is associated with adverse health effects in many regions of the world, where

* Corresponding author.
E-mail address: apascha@fmenr.duth.gr (A.K. Paschalidou).

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Fig. 1. Office of National Statistics study regions.

strong links between ambient temperature and increased mortality have been reported (Ferreira Braga et al., 2001; Basu and Samet, 2002; Donaldson et al., 2003; Basu et al., 2008; Basu, 2009; Guo et al., 2013; Urban et al., 2014; Wang et al., 2014; Tsangari et al., 2016). However, the exact shape of the exposure-response curve has been found to vary with location and latitude, depending on a number of physiological and behavioral factors (Guo et al., 2014; Keatinge et al., 2000). Physiological factors include acclimatization to extreme ambient

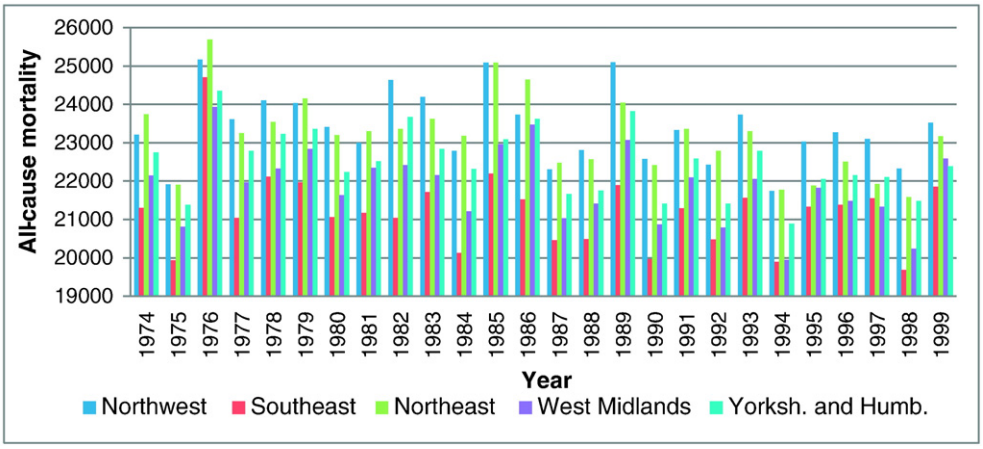

Fig. 2. The number of deaths per year for each of the five regions.