



Summer warming trends, heat waves and health impact in the Paris metropolitan area

Benedicte Dousset (1,2), Françoise Gourmelon (2), Karine Laaidi (3), Abdelkrim Zeghnoun (3), Emmanuel Giraudet (2), Philippe Bretin (3), and Stéphanie Vandentorren (3)

(1) Hawaii Institute of Geophysics and Planetology University of Hawaii, Honolulu, United States (bdousset@hawaii.edu), (2) Laboratoire Géomer CNRS, Institut Universitaire Européen de la Mer, Plouzané, France, (3) Institut de Veille Sanitaire, Saint Maurice, France

Summer warming trends are increasing the incidence, intensity, and duration of heat waves. Those are especially deadly in large cities, owing to high population densities, surface characteristics, heat island effects, anthropogenic heat and pollutants. In August 2003, a persistent anticyclone over Western Europe generated a heat wave of exceptional strength and duration with 4867 excess deaths in the Paris region. A series of 61 NOAA-AVHRR satellite images and a health case study were used to analyze Land Surface Temperature (LST) and its related mortality in the Paris region. LSTs were merged with land use and cover data to identify risk areas. Thermal indicators were produced at the addresses of 482 elderly people (aged > 65) to assess heat exposure. Minimal, maximal and mean temperature indices were built over different periods of time, and integrated into a logistic regression model adjusted to other risk factors. Results indicate: (i) contrasting night-time and daytime heat island patterns related to land use and surface characteristics; (ii) the relation between night-time heat islands and heat wave intensity; (iii) the impact of elevated minimal temperatures during consecutive nights on excess mortality, with a 0.5°C increase doubling the risk of death (in the temperature range of the heat wave); iv) the correlation between the spatial distribution of highest night-time LSTs and that of highest mortality ratios; and v) the significant impact of urban parks in the partitioning between latent and sensible surface heat fluxes, despite a prior warm and dry spring. Satellite monitoring of heat waves in urban areas improve our understanding of LST processes and spatial variability, and related heat stress and mortality. These observations provide criteria for anticipation of health risks, contingency policies and planning, and climate adaptation and mitigation strategies.

Keywords: Urban climate, heat islands, heat waves, heat stress and mortality, thermal remote sensing, climate change.