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Developing a Multivariate System for Predicting and Mitigating the Health Effects ofHeat waves in Niterói, Rio de Janeiro

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This study aims to develop a heat wave forecasting system using a new multivariate index that encompasses hydration-related mitigation measures. Heatwaves have increasingly occurred with greater frequency and intensity in various regions worldwide, particularly in Europe and Asia since 1990, although they are not exclusive to these areas. The principal health effects of heatwaves on populations include heat-related illnesses and fatalities, cardiovascular and kidney diseases, as well as adverse reproductive effects. These detrimental impacts are widespread and commonly affect individuals aged 65 and above. Many nations have established metrics to assess the prevalence of this occurrence within their borders. These metrics typically utilize specific thresholds and/or temperature ranges at a height of 2 meters, which denote extreme percentiles of values from past records. While some of these metrics consider the persistence of the phenomenon, few take into account the relative humidity. It is noteworthy that, in most instances, the temperature thresholds lead to a linear escalation in conditions posing a risk to the population. This can result in a biased perception of the actual level of risk involved. To thoroughly evaluate the health hazards associated with heatwaves, it is essential to acknowledge the considerable variability in global climate, as well as the diverse responses of living organisms to extreme temperature and humidity conditions. Furthermore, factors such as individuals' gender, race, age, pre-existing medical conditions, and geographical location should be taken into account.This study is divided into several components to reach a comprehensive solution. The first step involves determining the monthly distribution curve of accumulated daily maximum temperatures for each grid point of the ERA 5 data. After completing this process, machine learning models must be developed to calibrate the temperature values to the percentile of the cumulative distribution. Subsequently, the temperature value exceeding 95% of the distribution will be applied to this coefficient Coef = (e^{Tpe}*Ur)/1000, where Tpe is the value of the distribution that exceeds 95% and Ur is the relative humidity. These adjusted values will then be used to compute the normalized index I=(Coef-0.022)/9.7, accounting for the exponential temperature increase and providing weightage to the relative humidity. Upon establishment of these functions, a time series of the index value will be generated. This value will be multiplied by the hours of the day during which the index deviates from zero, facilitating the evaluation of its correlation with hospitalization and mortality data related to diseases such as thrombosis, which may be linked to

heat waves. The results of this phase will be presented at the Niterói region in Rio de Janeiro, Brazil, during the upcoming congress. Moreover, according to previous analyzes, since 2010 the frequency and intensity of heat waves have increased, being apparently modulated by Enso events and also by indices developed at LAMMOC/UFF related to anomalies of sea surface temperature of the Equatorial Atlantic Ocean and the South Atlantic Convergence Zone. Furthermore, the index data will subsequently undergo validation based on body water loss rates and their impact on blood viscosity fluctuations.