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Simulating human mobility with a Lagrangian Constraint Random Walk Model based on climatic and environmental conditions

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Archaeological records indicate that human population experienced frequent decline and growth as humans were on their way to populate the whole planet. Our hypothesis is that climate and environment were the main drivers for human existence and dispersal. Based on this hypothesis, we develop a Lagrangian Constraint Random Walk Model (CRW) to simulate the dispersal of hunter-gatherers. Human existence potential (HEP) is estimated using climate/environment model data, supported by archaeological evidence. The CRW simulates the movement of individual humans with a stochastic differential equation. While the movement of the individuals has a random component, it is constrained by a drift term which depends on the HEP. Population growth and decline are represented using a birth and a death term. Sociological elements of hunter-gatherers, such as population pressure, conflicts, and cooperation, are considered in the model. With the CRW, we estimate human mobility and dispersal based on the statistical behavior of a large ensemble of individuals. Furthermore, by varying the external factors and hence the HEP, we evaluate the response of hunter-gatherer societies to climate change. We will present the model and a case study on the mobility of hunter-gatherers on the Iberian Peninsula during the Last Glacial Maximum.