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Human dispersal on geographical scales DIRK BROCKMANN, Max Planck-Institute for Dynamics and Selforganization, Göttingen, Germany, LARS HUFNAGEL, KITP, Santa Barbara, THEO GEISEL, Max Planck-Institute for Dynamics and Selforganization, Göttingen, Germany — In order to account for various spatio-temporal phenomena in ecological systems, such as the geographical spread of epidemics, the knowledge of dynamical and statistical properties of human dispersal is of fundamental importance. However, these properties are difficult to assess mainly due to a lack of sufficiently large datasets. So far these properties could only be conjectured and the opinion that humans move diffusively still prevails in models. Based on a comprehensive dataset of over a million individual diplacements, collected over the past five years, we investigated the dynamical and statistical properties of human dispersal on geographical scales. We found that human dispersal is anomalous in two ways. First, the probability of finding a displacement of length x decays as a power law, indicating that trajectories of humans are reminiscent of Lévy flights characterized by a Lévy exponent $\mu \approx 1/2$. Secondly, the waiting time distribution exhibits a heavy tail as well implying a subdiffusive influence. Effectively, the scaling behavior of distance with time, $X(t) \sim t^p$ is superdiffusive with an exponent p near unity. We show that the stochastic dispersal can be accounted for in the continous time random walk framework yielding a bi-fractional Fokker-Planck equation. Our results represent the first solid and quantitative assessment of the properties of human dispersal on geographical scales.

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