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Prediction and predictability of global epidemics: the role of the airline transportation network VITTORIA COLIZZA, School of Informatics and Center for Biocomplexity - Indiana University, Bloomington IN, USA, ALAIN BARRAT, Unite' Mixte de Recherche (UMR 8627) du CNRS, Universite' de Paris-Sud. ORSAY, MARC BARTHELEMY, ALESSANDRO VESPIGNANI, School of Informatics and Center for Biocomplexity - Indiana University, Bloomington IN, USA — The systematic study of large-scale networks has unveiled the ubiquitous presence of connectivity patterns characterized by large scale heterogeneities and unbounded statistical fluctuations. These features affect dramatically the behavior of the diffusion processes occurring on networks, determining the ensuing statistical properties of their evolution pattern and dynamics. We present a stochastic computational framework for the forecast of global epidemics that considers the complete world-wide air travel infrastructure complemented with census population data. We address two basic issues in global epidemic modeling: i) We study the role of the large scale properties of the airline transportation network in determining the global diffusion pattern of emerging diseases; ii) We evaluate the reliability of forecasts and outbreak scenarios with respect to the intrinsic stochasticity of disease transmission and traffic flows. In order to address these issues we define a set of novel quantitative measures able to characterize the level of heterogeneity and predictability of the epidemic pattern. These measures may be used for the analysis of containment policies and epidemic risk assessment.

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