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Multifractals, random walks and Arctic sea ice[1] SAHIL AGARWAL, Yale University, JOHN WETTLAUFER, Yale University and Nordic Institute of Theoretical Physics (NORDITA) — We examine the long-term correlations and multifractal properties of daily satellite retrievals of Arctic sea ice albedo, extent, and ice velocity for decadal periods. The approach harnesses a recent development called Multifractal Temporally Weighted Detrended Fluctuation Analysis (MF-TWDFA), which exploits the intuition that points closer in time are more likely to be related than distant points. In both data sets we extract multiple crossover times, as characterized by generalized Hurst exponents, ranging from synoptic to decadal. The method goes beyond treatments that assume a single decay scale process, such as a first-order autoregression, which cannot be justifiably fit to these observations. The ice extent data exhibits white noise behavior from seasonal to bi-seasonal time scales, whereas the clear fingerprints of the short (weather) and long ($\sim$ 7 and 9 year) time scales remain, the latter associated with the recent decay in the ice cover. Thus, long term persistence is reentrant beyond the seasonal scale and it is not possible to distinguish whether a given ice extent minimum/maximum will be followed by a minimum/maximum that is larger or smaller in magnitude. The ice velocity data show long term persistence in auto covariance.

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