Abstract

Earth climate, in general, varies on many temporal and spatial scales. In particular, climate observables exhibit recurring patterns and quasi-oscillatory phenomena with different periods. Although these oscillations might be weak in amplitude, they might have a non-negligible influence on variability on shorter time-scales due to cross-scale interactions, recently observed by Paluš[1]. This thesis supplies an introductory material for inferring the cross-scale information transfer from observational data, where the time series of interest are obtained using wavelet transform, and possible information transfer is studied using the tools from information theory. Finally, cross-scale interactions are studied in two climate phenomena: air temperature variability in Europe, in which we study phase-amplitude coupling from a slower oscillatory mode with an 8-year period on faster variability and its effects, and El Niño/ Southern Oscillation where we observe a causal chain of phase-phase and phase-amplitude couplings among distinct oscillatory modes.