THE LABORATORY OF TREE-RING RESEARCH

presents a talk by

Valerie N. Livina

(National Physical Laboratory Teddington, UK)

Tipping point analysis of geophysical data

Wednesday, September 16, 2015 - 12:00pm to 1:00pm
Room: Bannister 110

We apply the tipping point toolbox [1-8] to study transitions and bifurcations in various geophysical datasets. We study early warning and detection signals of the records using methodology that combines degenerate fingerprinting and potential analysis techniques for anticipation, detection and forecast of tipping points in a dynamical system. Degenerate fingerprinting indicator is a dynamically derived lag-1 autocorrelation, ACF (or, alternatively, short-range scaling exponent of Detrended Fluctuation Analysis, DFA [1]), which shows short-term memory in a series. When such values rise monotonically, this indicates an upcoming transition or bifurcation in a series and can be used for early warning signals analysis.

The potential analysis detects a transition or bifurcation in a series at the time when it happens, which is illustrated in a special contour plot mapping the potential dynamics of the system [2-3]. The methodology has been extensively tested on artificial data and on various geophysical, ecological and industrial sensor datasets [2-9], and proved to be applicable to trajectories of dynamical systems of arbitrary origin [10].

References: [1] Livina and Lenton, GRL 2007; [2] Livina et al, Climate of the Past 2010; [3] Livina et al, Climate Dynamics 2011; [4] Livina et al, Physica A 2012; [5] Livina and Lenton, Cryosphere 2013; [6] Livina et al, Physica A 2013; [7] Livina et al, Journal of Civil Structural Health Monitoring, 2014; [8] Livina et al, Chaos 2015; [9] Perry et al, submitted; [10] Vaz Martins et al, PRE 2010.

THE UNIVERSITY OF ARIZONA