

A probabilistic early-warning signal for noise-induced tipping in quasi-stationary regimes of metastability

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Precursors and indicators

Definition

Early warning signals are simple properties that **change in characteristic ways** prior to a critical transition^[1].

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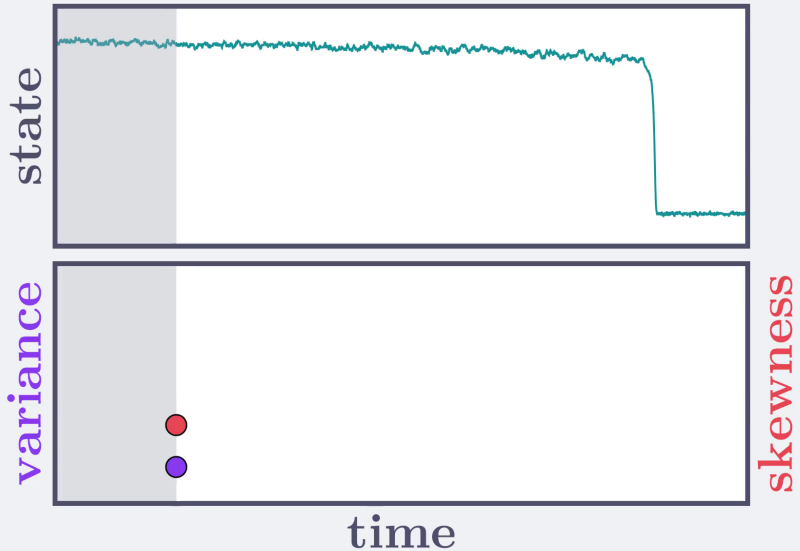
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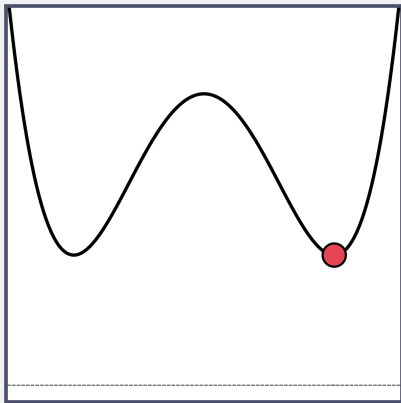
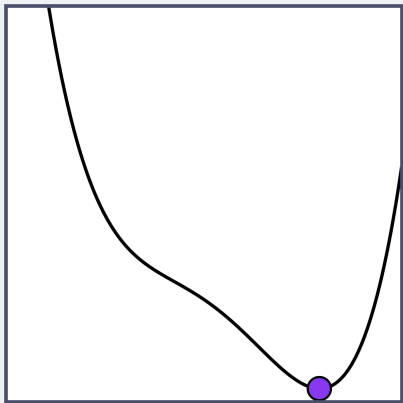
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Measures of incoming criticality



The stability landscape



A numerical method

Objective: derive an early-warning signal with the following desirable properties:

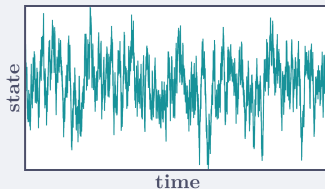
- has a physical interpretation;
- shows a consistent trend for an incoming tipping;
- relies on little to no prior knowledge of the nature of the system.

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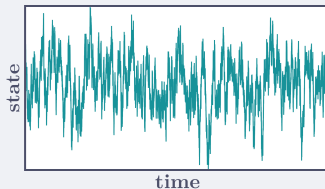
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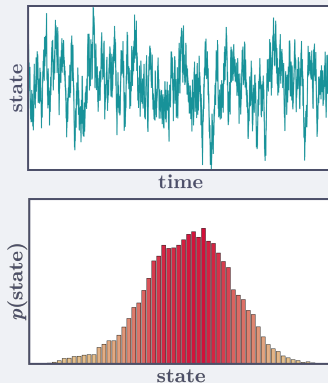
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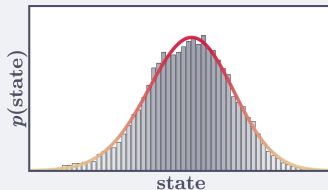
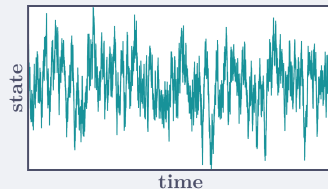
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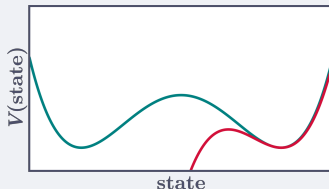
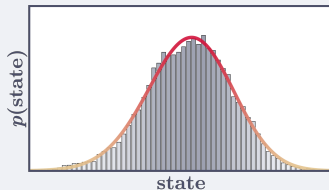
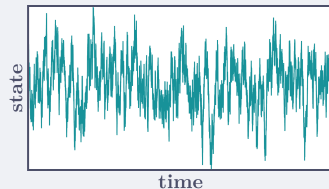
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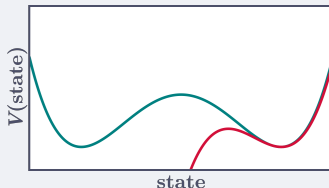
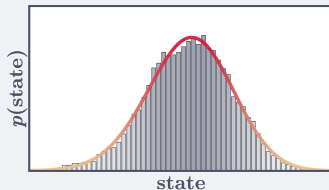
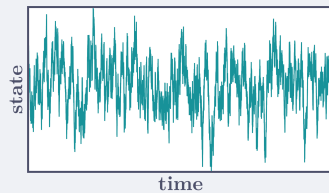
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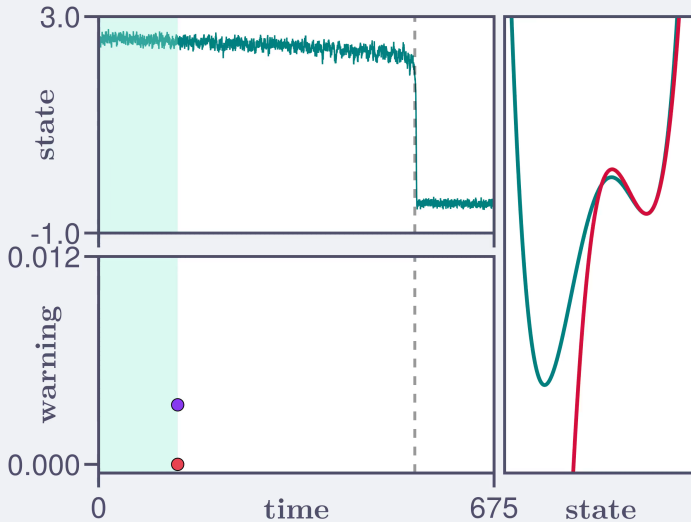
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3) **Output:** probability of tipping^[3]



An EWS from data



References



H. A. Kramers, Physica **7** (1940).



C. Kuehn, Physica D **240** (2011).



M. Scheffer, et al., Science **338** (2012).

Thank you.

► Go to beginning

► Go to the variance eqns

► Go to numerical method