HIRATA LAB.

［Revealing hidden patterns within time series data］

Collaborative Research Center for Innovative Mathematical Modelling

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Nonlinear Time Series Analysis

Department of Mathematical Informatics, Graduate School of Information Science and Technology

Nonlinear Time Series Analysis and its Cross-disciplinary Applications

This laboratory develops methods for nonlinear time series analysis and applies the methods to real datasets of important problems including ones from lives, brains, cancers, earthquakes, weather, renewable energy, and foreign exchange markets. Our current main focusses include (i) developing methods for analyzing point process data, where events are observed at irregular times, (ii) personalizing treatments of cancers, which hopefully improves the quality of life, and (iii) understanding high-dimensional time series in intuitive ways.
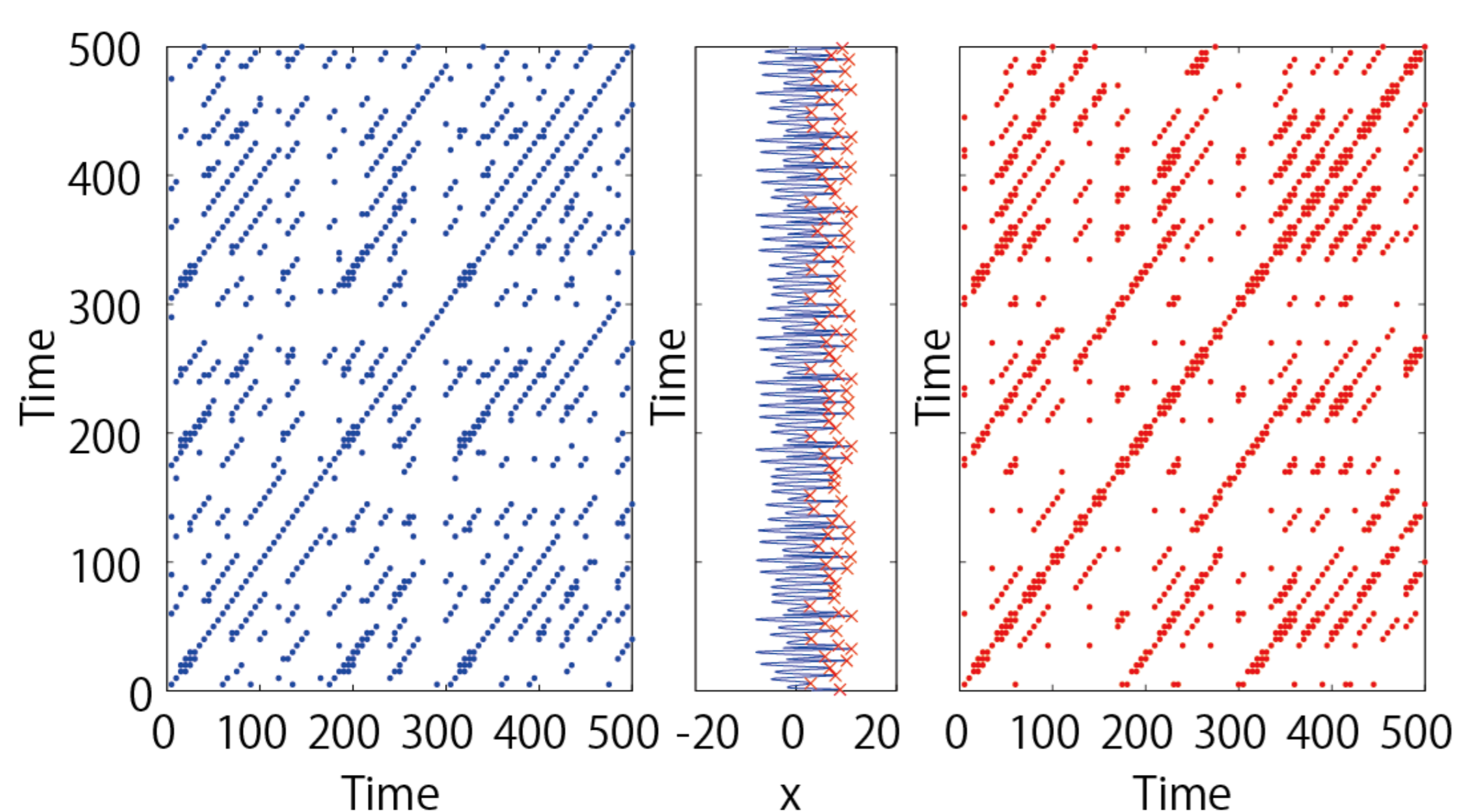

Fig. 1. Recurrence plot (left) of the original time series (middle, blue line) generated From Rössler system and recurrence plot (right) obtained from Its local maxima series (middle, red crosses) using the distance for marked point processes.
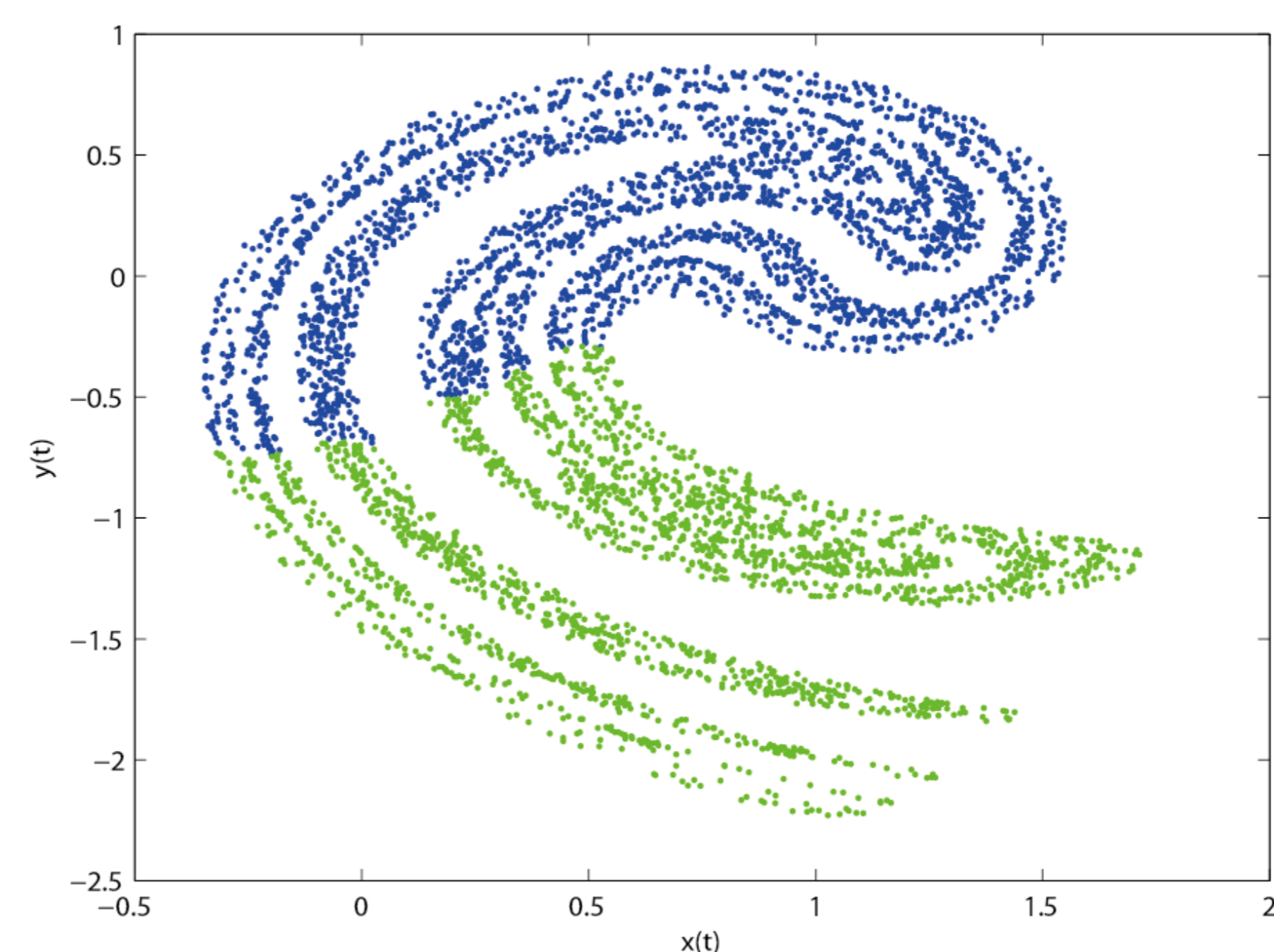(ref: Suzuki, Hirata, and Aihara, Int. J. Bifurcat. Chaos (2010))

Fig. 2. Noisy Ikeda map partitioned into two in such a way that the information related to dynamics is maximally preserved.
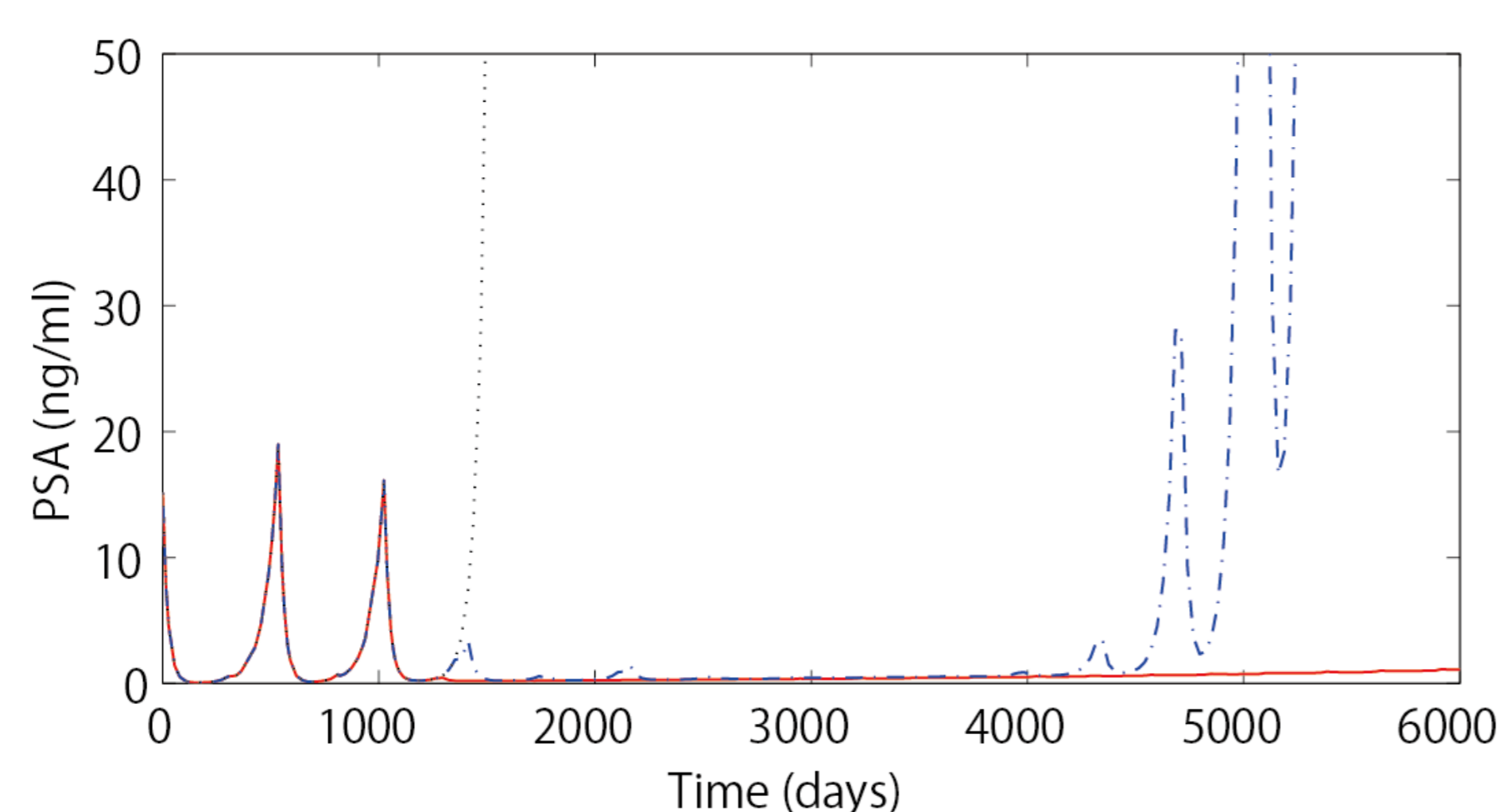(ref：Hirata and Aihara, Eur. Phys. J. Spec. Top. (2013))

Fig. 3. Intermittent androgen suppression for prostate cancer:
Current standard protocol (black dotted line),
minimization of growth rate (blue dash-dotted line),
And model predictive control (red solid line)
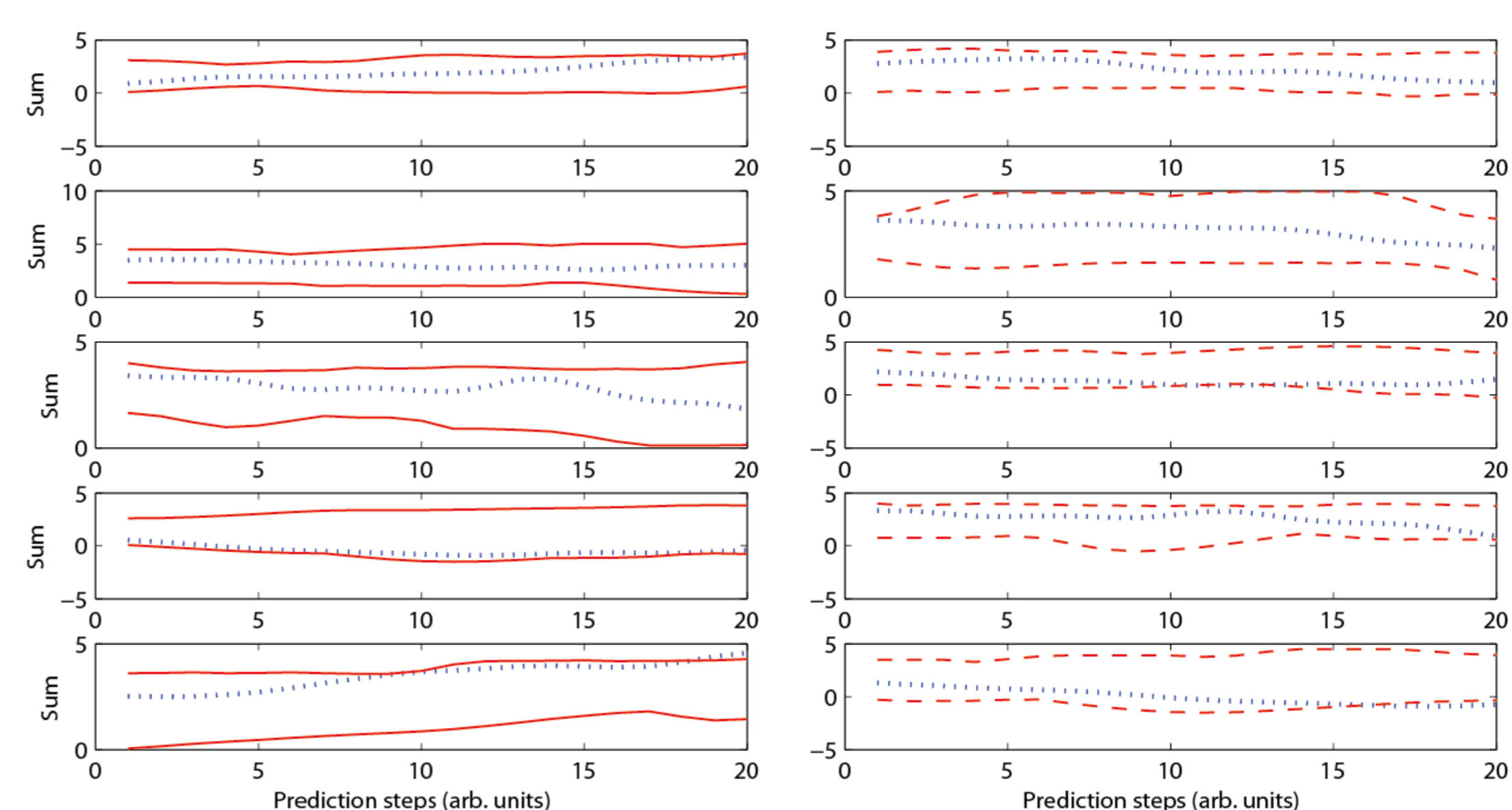(ref：Hirata, Azuma, and Aihara, Methods (2014))

Fig. 4. Time series prediction with confidence intervals：
Actual values (blue dotted lines) and
96% confidence interval (red lines)
(ref：Hirata et al., Renew. Energy (2014))

Institute of Industrial Science