

Predict the sea *surge*

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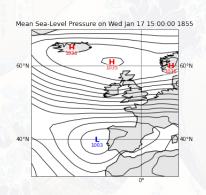
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- Tide composed of astronomical tide and radiational tide. Easily predicted.



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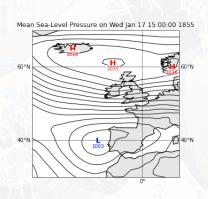
- ▶ Variations of sea level composed of tide and surge.
- Tide composed of astronomical tide and radiational tide. Easily predicted.
- Surge is the difference between observed sea level and tide. Critical importance for safety reasons.

Data description



- Sea-level pressure field (SLP).
- Sea surges of two (unknown) cities.

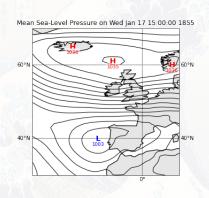
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- Data from 1950s to 2010s.
- Windows of five days.
- ► SLP: 41×41 grid, every 3 hours.
- Surges: Normalized, every 12 hours.

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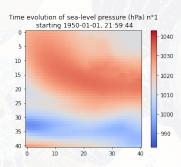


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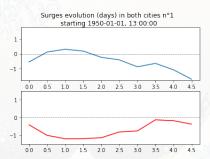
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Output: Surges on next five days.

Example data

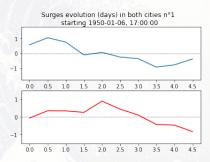


Input:



Example data

Output:

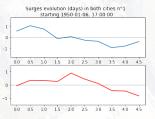


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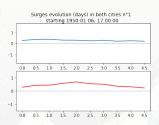
- ▶ Metric: L^2 loss function, weight (1, 0.9, ..., 0.1).
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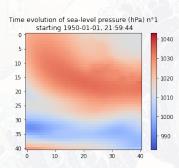
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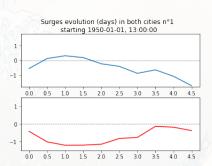
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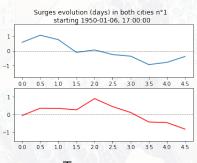
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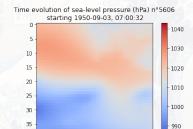


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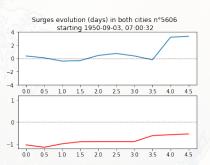
Our prediction

Comparison to benchmark



20

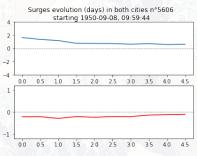
30



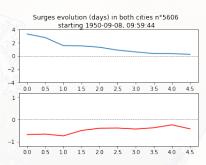
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10

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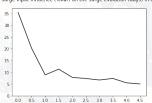
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- ► SLPs:
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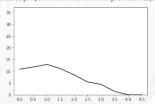
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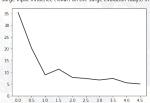
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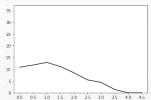
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► <u>Time</u>: 6.6% (resp. 5.3%) variance increase every 10 years in city 1 (resp. 2). Global warming?

Issues and other attempted methods

Data correlation:

- 1. Windows of data over 5 days, but samples every day.
- 2. If one takes only unoverlapped data, test efficiency decreases.
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- <u>Neural Network</u> instead of Lasso regression? Either overfits or behaves poorly compared to Lasso.



Conclusion and further directions

- ► We have developped a simple method, using only PCA and Lasso regression, to predict sea surges.
- Explains > 50% of variance (benchmark 23%, best 56%).
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- Preprocessing of SLPs in another (and more significant) way than PCA?
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- ► Thank you!







Paul Fermé

FML challenge: Can you predict the tide?