Rainfall data and insurance damage data related to sewer flooding for the case of Aarhus, Denmark

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Rainfall – insurance damage claims: is there a relationship?
Aarhus City:
- 315,000 inhabitants
- 47,000 hectares
- Elevation: 0-107m+MSL
Insurance claim database:
- 1044 geo-referenced records; property and content damage
- 24/7 service

- 813 records used
- within 6 km range of 2 rain gauges
- period 2005-2009
Relationship rainfall – insurance damage claims?

Problem:
Lagged response of damage claim to time of rainfall event causing damage
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Solution:
- impulse-response function (lagged regression) – from signal processing (cf. electric pulse)
- Precondition: impulse is short compared to response; impulse is immediate (infinitely short).
- Here: impulse = rainfall (min-hours); response = claims (days)
Cross correlation max rainfall intensity [mm/h] vs nr of claims [/-day] as a function of lag time [days].
Cross correlation max rainfall intensity [mm/h] vs nr of claims [-/day] as a function of lag time [days]

- Strongest cross-correlation on day 0
- Significant correlation (at 1% level) for lag 1,2,3 days

- Significant correlation for day -1: damage previous to rainfall?

- Probably: start rainfall series first hourly window 23h-0h is from previous day
Nr of damage claims predicted vs observed

(SQRT(nr claims))
Correlation coefficients (Pearson)

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<tr>
<th>Model</th>
<th>Northern suburb</th>
<th>City centre</th>
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<tbody>
<tr>
<td></td>
<td>dcounts</td>
<td>dtot</td>
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<tr>
<td><strong>rmax</strong></td>
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<tr>
<td>Linear</td>
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<tr>
<td>Linear, time-invariant</td>
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<td>0.53</td>
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<tr>
<td>Avg. distance claim-rain gauge</td>
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<tr>
<td>Total number of claims</td>
<td>363</td>
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</tbody>
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D_counts: nr of damage claims/day
D_tot: total damage volume/day
Prediction of rainfall-related damage

Needs for improvement:

- accurate insurance data: in time and space
- accurate rainfall data: especially in space (rainfall radar)
- additional data sources: topography, local drainage, socioeconomic data
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