Reconciling weather data with insurance data

Hanna Płotka, Agri & Specialty Risk Modelling, SCOR Global P&C
<table>
<thead>
<tr>
<th></th>
<th>Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>STRATUS – methodology</td>
</tr>
<tr>
<td>3</td>
<td>STRATUS – an example</td>
</tr>
<tr>
<td>4</td>
<td>Summary and conclusions</td>
</tr>
</tbody>
</table>
Introduction

- Understanding and assessing large weather events is crucial for designing sustainable insurance programs, but these events are rare.

- Two classes of data available
  - Insurance data
    - De-trended and restated
    - Often short (~10 years, if we are lucky)
  - Weather data
    - Longer history: satellite observations since 1979, weather stations go even further back.
    - Gridded: information in both space and time.
    - Complicated to use, hard to link with agricultural losses.

Access to weather-related information can improve our view of the risk.
# Reconciling weather data with insurance data

<table>
<thead>
<tr>
<th></th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
</tr>
<tr>
<td>2</td>
<td>STRATUS – methodology</td>
</tr>
<tr>
<td>3</td>
<td>STRATUS – an example</td>
</tr>
<tr>
<td>4</td>
<td>Summary and conclusions</td>
</tr>
</tbody>
</table>
STRATUS – a SCOR tool for looking at weather data

At SCOR, we have developed a methodology for a combined view of weather and insurance data in a tool called STRATUS.

- Global weather data is available in the tool and user needs to select a variable and region of interest.

What STRATUS can do:

- Tell you past and present weather conditions for a certain exposure. This includes:
  - Qualitative estimation of the hazard,
  - Estimates of return periods.
- Compare these weather conditions with restated insurance losses for the peril in question.

What STRATUS cannot do:

- Account for multiple weather factors.
- Account for non-weather factors (farming practices, disease, etc.).
Tool overview

User input: index construction
- dataset
- variable
- region
- time window
- threshold

User input: insurance information
- exposure
- losses

Processing
- data extraction tool
- filter by elevation (optional)
- add up index weighed by exposure
- calculate index

Output
- correlation with losses
- return periods
- maps/animations
- sensitivity analysis
Reconciling weather data with insurance data

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
</tr>
<tr>
<td>2</td>
<td>STRATUS – methodology</td>
</tr>
<tr>
<td>3</td>
<td>STRATUS – an example</td>
</tr>
<tr>
<td>4</td>
<td>Summary and conclusions</td>
</tr>
</tbody>
</table>
Freeze events in Switzerland – hypothetical example

Consider a hypothetical insurance program in Switzerland:

- Relatively new – only 7 years of loss history,
- Various crops and perils are covered throughout the country,
- The scheme suffered large losses twice, both times coming from early spring freeze events affecting flowering fruit trees.

**Is the scheme sustainable? What is a return period of such events?**

- Data necessary for analysis using STRATUS:
  - Exposure of fruit trees insured by the cover (here, we use data from Caloz & Boehlen (2015)),
  - Losses from freeze events on fruit trees, given present-day exposure.
STRATUS – Index construction

- **Dataset:** Gridded minimum daily temperature from CFSR reanalysis dataset (Saha et al. (2010), Saha et al. (2014)).

- **Index:** Consecutive days temperature index (Klein Tank et al. 2009)
  - Reflects the amplitude and persistence of heat and cold conditions.

- **Time period:** Spring when the fruit trees are flowering
  - The exact dates vary from year to year,
  - Critical time period was determined to be the period between 1st April and 31st May.

- **Data filtering:** Exclude regions with topography over 1000m.

- **Threshold:** -2°C.
STRATUS – results – hypothetical example

### Exposure in Switzerland

### Index times Exposure in Switzerland 2013

### Aggregate Index in Switzerland

<table>
<thead>
<tr>
<th>Year</th>
<th>Rank Index</th>
<th>Return Period</th>
<th>Rank Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>8</td>
<td>4.75</td>
<td>1</td>
</tr>
<tr>
<td>2015</td>
<td>11</td>
<td>3.45</td>
<td>2</td>
</tr>
<tr>
<td>2016</td>
<td>19</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2011</td>
<td>23</td>
<td>1.65</td>
<td>4.5</td>
</tr>
<tr>
<td>2012</td>
<td>29.5</td>
<td>1.29</td>
<td>4.5</td>
</tr>
</tbody>
</table>
STRATUS – how it looks
### Reconciling weather data with insurance data

<table>
<thead>
<tr>
<th></th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
</tr>
<tr>
<td>2</td>
<td>STRATUS – methodology</td>
</tr>
<tr>
<td>3</td>
<td>STRATUS – an example</td>
</tr>
<tr>
<td>4</td>
<td>Summary and conclusions</td>
</tr>
</tbody>
</table>
Summary and conclusions

- Examining agricultural insurance data from a pure insurance or a pure weather perspective gives a limited view.

- STRATUS is a tool with an embedded methodology for addressing this issue – allowing a more in-depth view of the risk.
  - May be used as a first and important step for analysing insurance programmes.

- Of course, many factors play a role in agricultural production:
  - Different crops are sensitive to different factors at different growth stages,
  - Multiple weather factors interact,
  - There are limitations in using indices.