Post-event assessment of extreme events using winter storms as an example

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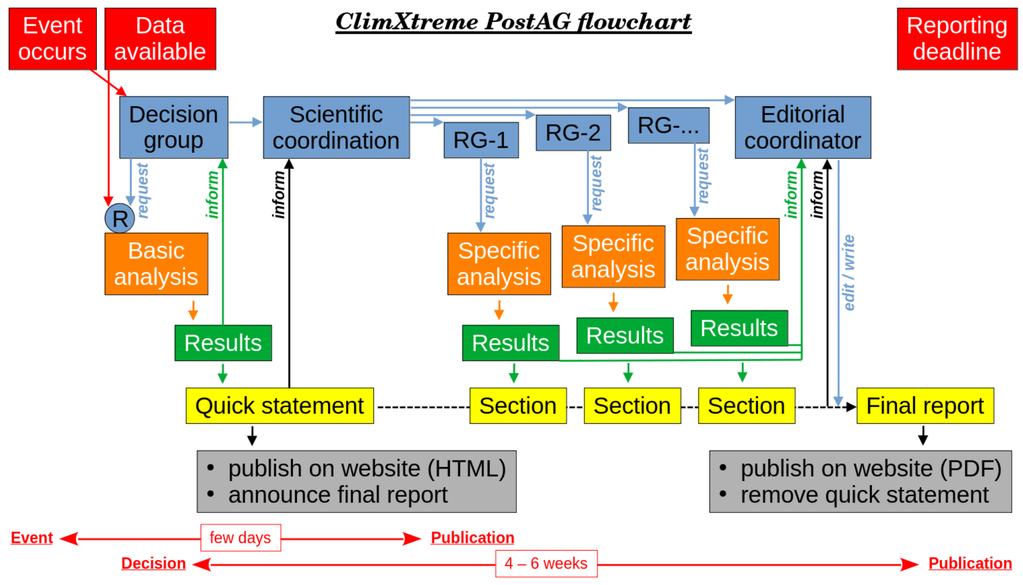
Jens Grieger[1], Torben Kunz[2], and Uwe Ulbrich[1]

[1]Institute of Meteorology, Freie Universität Berlin, [2]Deutscher Wetterdienst

Introduction

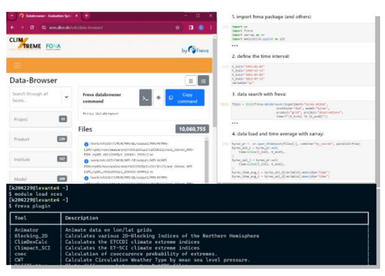
- General demand for information after the occurence of extreme events
- Requests by media, stakeholders, funding agency (BMFTR)
- Several institutions are (operationally) preparing assessments, e.g. DWD, CEDIM, WWA
- Aim of ClimXtreme Post-event Assessment Group (PostAG) is to add on these activities with the numerous perspectives in the research project focusing on extreme events and climate change
- Two step approach:
  1) pre-defined quick analysis
  2) supplement of further analysis with new methodologies developed by the research program leads to a report after 4-6 weeks

Post-event Assessment Group (PostAG)



PostAG workflows using ClimXtreme Central Evaluation System (XCES)

Central Evaluation System (XCES)



Access via web, command line, python

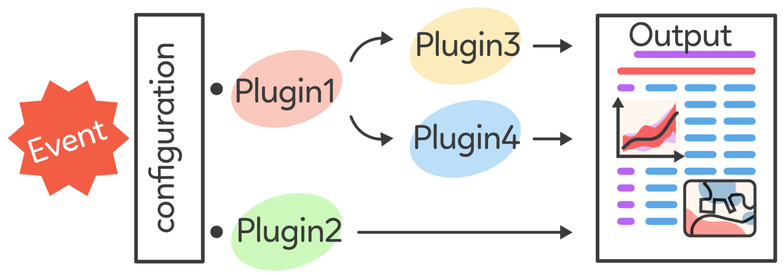
- Standardized data, plugins, results

Assessment workflows

- Routines for:
  - event description
  - Impact
  - historical and future climate change
- Basic workflows of plugins plus specific analysis
- fed by near-real time data @ XCES (e.g. ERA5, HYRAS)

Configurations for event types

- Predefined configuration for each type of event
- Collection of data & plots, here via **jupyter notebooks**.



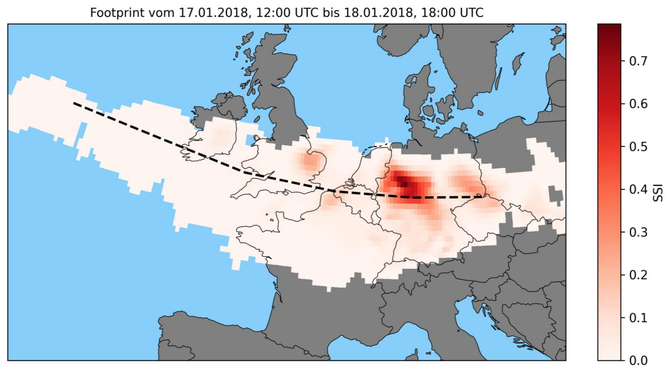
Basic workflow for winter wind storms

(1) Identification and tracking of storm

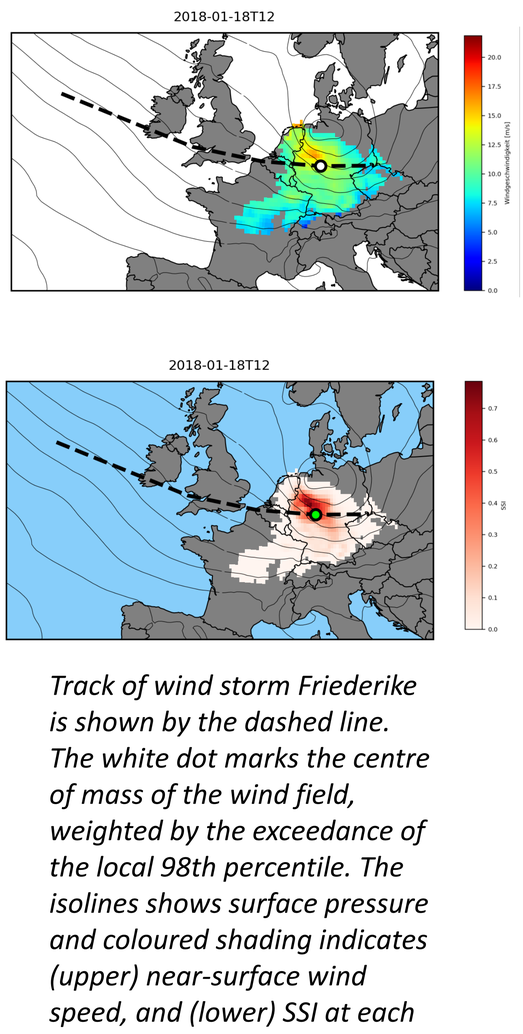
- Wind storms tracking of Leckebusch et al. (2008) is applied to ERA5 reanalysis
- Tracking uses near surface wind speed
- Grid cells where local 98th percentile is exceeded are used to storm identification
- Loss motivated storm severity index (SSI) is calculated
- The cubic exceedance of local percentile of wind speed is integrated over all time steps and grid cells of the storm event.

$$SSI = \sum_t^T \sum_k^K \left(\max\left(\frac{v_{k,t}}{v_{98,k}} - 1 \right), 0 \right)^3$$

$v_{k,t}$: wind speed at grid cell k and time t
$V_{98,k}$: local 98th percentile of wind speed at grid cell k



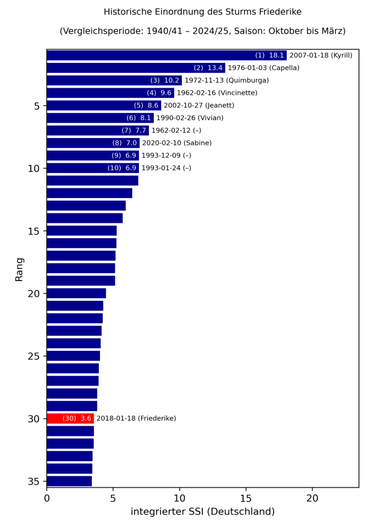
Footprint of storm Friederike. Coloured shading shows temporally integrated SSI from 2018-01-17, 12 UTC to 2018-01-18, 18 UTC.



Track of wind storm Friederike is shown by the dashed line. The white dot marks the centre of mass of the wind field, weighted by the exceedance of the local 98th percentile. The isolines shows surface pressure and coloured shading indicates (upper) near-surface wind speed, and (lower) SSI at each grid cell for the time step 2018-01-18 12 UTC.

(2) Ranking of event

- Calculation of SSI value only for Germany
- Comparison with all events during winter season 1940/41 to 2024/25
- Ranking by means of SSI as loss motivated integrated measure



Friederike ranks on 30 for Germany with respect to SSI in comparison to all winter events between 1940/41 and 2024/25

Automatic generation of small report

- Small data sheet for each event is generated after assessment, near-real time, when data is available
- Additional analysis can be included via XCES (e.g. storm loss model of project C9)

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jens.grieger@fu-berlin.de

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