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XCES Plugins

Table 1: plugins developed during ClimXtreme2.

plugin	Description	Project	status
CROP	Impact of extreme events on crops	C3	Central
PCA	principal component analysis based on xeoFs	B1.1/B3.7	Central
PrecipReturnPeriodMaps	maps of precipitation sums and return periods	C1	Central
PredictBuildingDamage	maps loss ratio exceedance probabilities for building damage	C1	Central
SECSF	Crop-yield emulation with SECSF surrogate model	C3	Central
Trendtest	linear trends with significance test	B1.1/B3.7	Central
Analogues	analysis of circulation analogues	B1.1/B3.7	Local
Dacollector	data preparation	B1.1/B3.7	Local
Dsmetrics	Dynamical system metrics	B1.1/B3.7	Local
Dualtrees2d	2d wavelet transforms	B1.1/B3.7	Local
FloodExtent	Estimate fluvial flood affected extent	C5	Local
Markov_attribution	Impact of extreme events on crops	C3	Local
Regional_hwmid	Regional heat wave evaluation using HWMID	B3.7	Local
SLBM	GEV distribution of sliding block maxima	B3.7	Local
Sousa_blocking	Atmospheric blockings	A5	Local
SPEI	Drought indices SPI and SPEI	B1.1/B3.7	Local
TGCCA	TGCCA on climate and crop-growth drivers	C3	Local
TLSW	Smooth trend autocovariance functions via wavelets	B1.1/B3.7	Local

Plugin Overall Status:

- Centrally plugged: 30
- Functional but not yet: 12

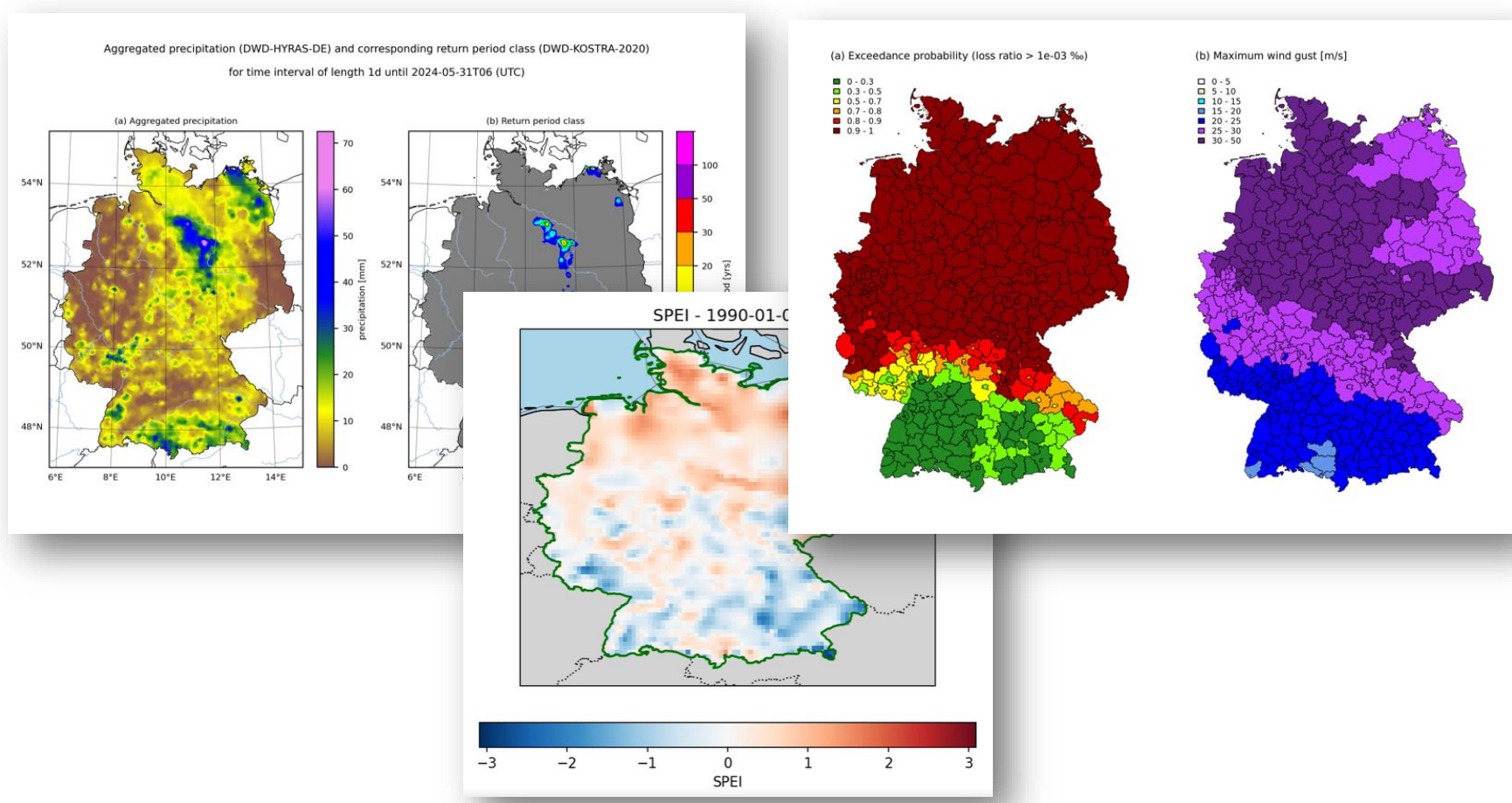


Figure 5: (left to right) examples of plugins available from Phase2; precip return period, Crops, prediction building damage.

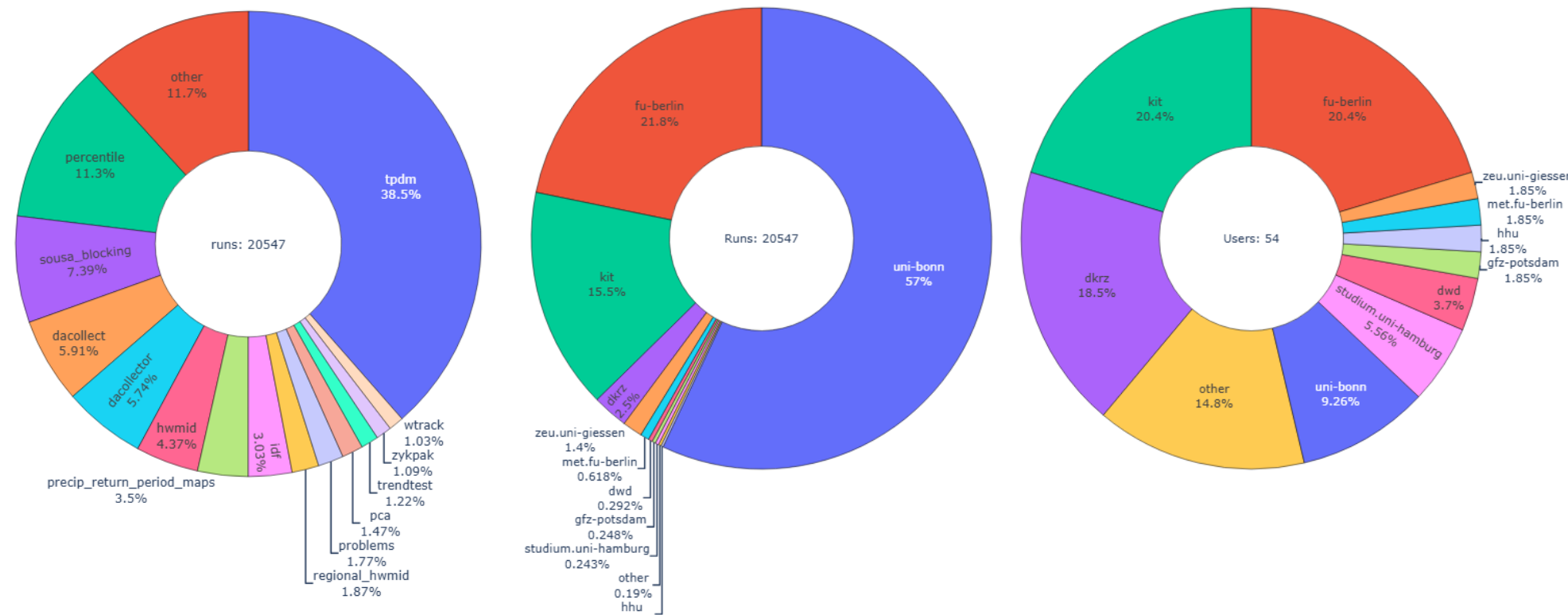


Figure 6: (left to right) plugin runs, runs per institution, users per institution (2023.07.01-).

Work in Progress:

- Focus: plugins for PostAG workflows.
- Quality: docu, tests, DWD transfer
- Updates: new endpoints/HealPix/...

PostAG Workflows

Aim of ClimXtreme PostAG

- Facilitate rapid assessment of current extreme weather events
- Publish report a few weeks after the event
- Inform about event intensity, return period, impact, processes
- Highlight methodology developed within ClimXtreme

Workflow strategy

- Combine resources supported and maintained by Module D:
 - (a) Freva databrowser (near-realtime data: ERA5, Hyras, Radolan, ...)
 - (b) Freva plugins (tools applying ClimXtreme methodology)
- into a python jupyter notebook, using freva-python interface
- One notebook per event type (wind storm, precipitation, heat)
- Allows event assessment within 1 hour once data are available

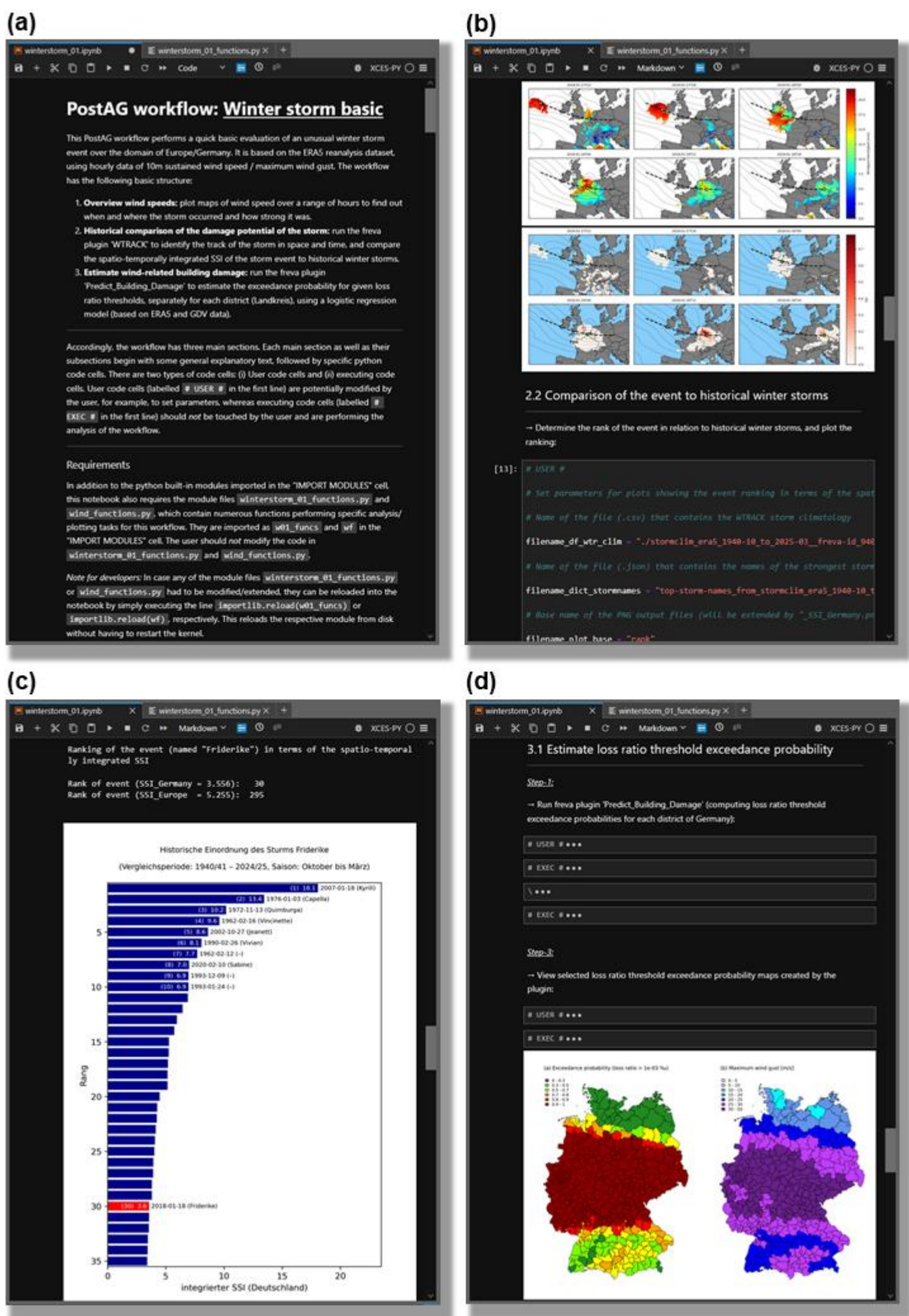


Figure 2: Example workflow for winter storm events (based on ERA5 reanalysis), illustrating (a) user-friendly design; and the obtained results, which are (b) the spatial track of the extreme wind field, (c) the ranking of the damage potential, integrated over Germany / Europe, and (d) a map of loss ratio exceedance probability.

Data Analysis

How does data uncertainty affect extreme event analysis?

- Currently ongoing work:
 - Systematic estimation of the uncertainty of spatially integrated indices (Kenntage) (ice days, frost days, summer days, hot days) – a product regularly provided by DWD –, if based on the HYRAS-DE (1 km x 1 km) dataset, as a function of spatial scale, and in relation to the expected sampling error of 30-year climatological averages.
- Planned work:
 - Provide uncertainty information for user-specific products, for example, for averages over specific geographic regions.

Usability Beyond ClimXtreme

Freva plugins

- DKRZ gitlab & Freva beta instances (freva.dkrz.de):
 - make freva plugins available to other projects
 - ensure opportunity for plugin maintenance
 - enable scientists to continue plugin development
- BUT: need to write WLA and usergroup to get service!

PostAG workflows

- Document workflows and evaluate their applicability for users beyond ClimXtreme – for example:
 - Ongoing effort to transfer wind storm workflow to DWD for operational use when reporting on current extreme events
 - Potentially usable for teaching at university