



## Web Processing Services for extreme weather event assessments

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We present the Web Processing Service (WPS) to calculate the weather regimes with its projections and analogs of atmospheric circulations and as follows perform the flow analogs analysis.

WPS is a technical solution in which the processes are hosted on the server and accessed over the web. The general idea of WPS is to let scientists remotely perform analysis of the models in HPC without downloading vast amount of data.

The work is carried out under the framework of ERC A2C2 project in collaboration with Mesocenter ESPRI at IPSL. The Mesocenter IPSL hosts several ESGF (Earth System Grid Federation) nodes with direct (and P2P) access to the climate models data, reanalyses and observations.

We have developed new WPS service, *blackswan*, as a further development of birdhouse *flyingpigeon* web processing service with a focus on the extreme weather events investigations.

This is an update of previous work of the several teams, from IPSL and LSCE in France and DKRZ in Germany.

PyWPS implementation of the Web processing Service standard from Open Geospatial Consortium (OGC) in the framework of *birdhouse* software is used and operates on IPSL compute node. Calculation of the analogs is based on the open source software CASTf90 (Circulation Analogue Simulation Tool in fortran90), *blackswan* is mainly written in Python, but also includes parts written in R scripts and CDO commands.

Service provides sophisticated web-based tool to calculate analogs or weather regimes over any selected spatial domain or season. Different reanalysis dataset for sea level pressure (SLP) or geopotential height could be used, e.g., NCEP/NCAR, 20<sup>th</sup> Century Reanalysis v2 (20CRv2) along with large ensembles of CMIP5 (and later CMIP6) models or CORDEX data.

The distribution of the analogs allows to compute the probability of observing an SLP pattern (given a history of pattern) and return times of SLP patterns (the time to wait for a pattern to recur).

The results are further used to compute flow analogues to analyze extreme events, relate them to large-scale atmospheric circulation, how they probability depends on climate forcing, analyze the probability of events with no analogues in the past (“black swans”) etc.

We will give an overview of the service, its perspectives and usage examples.