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## The GeoStat-Framework: Create your geostatistical model in Python!

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The **GeoStat Framework** is a coherent ecosystem of Python packages for geostatistical applications and subsurface simulations.

It provides an easily usable open source collection of software packages. They are well documented, including exhaustive hands-on guides and examples for helping non-programmers and non-domain-experts getting started. The main applications of the packages are:

- **GSTools** & **PyKrige** - spatial random field generation, kriging, data normalization & transformation, and geostatistical analyses based on variogram methods
- **AnaFlow** - (semi-)analytical solutions for specific groundwater-flow scenarios and the extended *Generalized Radial Flow* model

- **welltestpy** - store, manipulate, and analyze well-based field testing campaigns with a focus on estimating parameters of subsurface heterogeneity from pumping test data.
- **ogs5py** - pre-processing, operating, and post-processing of subsurface flow and transport simulations by providing a Python API for the FEM solver OpenGeoSys 5

With this collection of flexible toolboxes we aim to close the gap of missing software for real-world applications in the field of geostatistics.

Especially GStools is the first comprehensive Python-toolbox for covariance models, field generation, kriging, variogram estimation, data normalization and transformation. The formerly independent project PyKrige, developed by Benjamin Murphy, has been migrated to the GeoStat-Framework und we started to build a common Rust backend for the numerical heavy lifting called GStools-Core.

We will show a set of complex workflow examples, like temperature trend analysis and pumping test ensemble simulations, and we will give an overview of the provided functionality and an outlook for the future. All workflows are made accessible as *GeoStat-Examples* repositories.

## References

- *GStools*: Müller, S., et. al. <https://doi.org/10.5194/gmd-2021-301>, 2021 (in review)
- *AnaFlow*: Müller, S., et. al. <https://doi.org/10.1016/j.advwatres.2021.104027>, 2021
- *welltestpy*: Müller, S., et. al. <https://doi.org/10.1111/gwat.13121>, 2021
- *ogs5py*: Müller, S., et. al. <https://doi.org/10.1111/gwat.13017>, 2020

## Links

- Website: <https://geostat-framework.org/>
- GitHub: <https://github.com/GeoStat-Framework>
- GeoStat-Examples: <https://github.com/GeoStat-Examples>