Webinar Q&A: Model groundwater level time series with Pastas

#	Questions	Answers
1	How do you determine the 'a' in the formula?	The model parameters are estimated by fitting simulated values on (a part of) the observations.
2	How long time series is required for a pastas model and what is the minimum sample interval recommended?	Good question! It really depends on the time scale of the influences you want to model. If you want to model the effect of tidal influences you need data with a very high frequency, at least hourly, but you don't need a very long time series, weeks may be enough. Whereas if you want to model the effect of recharge on an aquifer you sometimes need over 30 years of measurements and a measurement frequency of once a month may be sufficient.
		Thank you for the reply! Would it be possible to shorten the required length of the time series by using a higher measurement frequency to model recharge? e.g would it be possible to use a three year time series which was measured daily?
		More measurements does not necessarily mean more information, so one should test how the results change when lengthening or shortening the calibration period. We typically work with weekly measurements and found that for many systems daily data already does not provide more information to infer the parameters.
3	How does it calibrate itself? Need more info pls.	You need to calibrate it yourself using the tools in pastas. This will be covered more in detail during the course. It is also explained in the documentation
4	Have you run into issues where the timestamps on the different datasets (rain, evap, heads etc) don't match and it causes a problem with combining the datasets for the model?	Yes, this can be a pain. Data preparation is a very important part of the modelling. In the course we will go into handling different timestamps.
5	Is it possible to estimate hydraulic parameters of the aquifer using pastas? I remember seeing a package called "hydrogeosines" that does that, but seems that it is not updated anymore.	There have been several attempts to this but this is not really the purpose of the package. I think the Hydrogeosines package is a better option for this purpose :)
		Hi Raoul, thanks for your answer - I can imagine how complex the package already is and how it would be to add this. I thought using a multi approach / multi package would be the best approach. Thanks!
6	What does "d" really represent: the bottom of the aquifer or the reference datum used? How to estimate initial realistic values of this parameter? Is PASTAS used for both confined and unconfined observation wells?	live answered
7	Under what conditions does the model PASTAS become stronger or weaker in representing hydrogeological time series?	Thanks for your question. Can you perhaps specify a bit more what you mean with weaker or stronger?
		How does the model behave when the aquifer is subject to varying conditions like confinement, geological structures, and boundary influences? Is it able to capture these effects? For which types of hydrogeological problems is the model most suitable? thanks!
8	Could pastas be used to modeling spring fluxes instead of heads?	We've done some research on spring discharge data: https://doi.org/10.1007/s12665-023-11012-z
		Raoul, would this approach from the spring paper work for springs in other aquifer types or only karsts (just skimmed through the article title)
9	Can we accurately simulate the water supply for a region that lacks any observational data and instead relies solely on other simulation data for modeling?	We can do that if we have the pumping rates, but we always need those time series of explanatory variables as well.
10	How is the monitoring location considered? for if the monitoring well and river gauge locations are not at the same position. how to deal with the spatial variation?	Good question, we typically take the closest measurement point, but this has some assumptions of course!
11	Does the units of the input/stresses (especially of the extraction rate) matter for the pastas model?	This depends on the model, but in principle the units don't matter. depending on the units it mayb be easier or more difficult to estimate parameters and scaling it might help
12	Could you please tell me any other solution if we do not have pumping data?	Unfortunately Pastas won't work in this case
13	Hi Raoul - thanks for the presentation and for answering the questions. With regards to the dike example, if the river water level increases what type of response function is used? Have you found that the groundwater head on the land side of a increases linearly with an increase in river stage or is it non-linear with increasing stage?	live answered
13	Hi Raoul - thanks for the presentation and for answering the questions. With regards to the dike example, if the river water level increases what type of response function is used? Have you found that the groundwater head on the land side of a increases linearly with an increase in river stage or is it non-linear with increasing stage?	The flood wave example from Onno is what I am interested in. Would you expect the model relationships to hold under extreme conditions if the model has been calibrated under more typical conditions. Bedankt, Nick
14	so the fit is done completely automatically ??	There are many optionsto estimate the parameters (least squares, pest, mcmc), or even manual. You can even apply your own routine from another Python package.
		are the choice of the models also done automatically ?? as shown here in this slide ? Or do i have to test the different models on my own ?
		this module would perfectly fit my phd ;-). did you ever test the module with very large depths to groundwater ?
15	What are the assumptions governing uncertainty propogation from stresses to future predictions when using Pastas to forecast heads?	Depending on how you set it up. This can be input data uncertainty, parameter uncertainty, or even multimodel uncertainty.
16	what is the unit of the influences? Is it the water level fluctuation or a relative contribution to it?	The units can be anything, but we have recommendations. Often in length (meters) or a flux (m3/d)
17	Are there any case studies/paper where time series was model was applied for a managed aquifer recharge? and any study on unconfined aquifers?	Check out the Brakenhoff et al paper : https://pastas.readthedocs.io/stable/about/publications.html
		Pastas are used for MAR, but no paper was published as it was conducted within a private company.
		ah, Thankyou!
18	Q2. How does the model estimate AET While using PET as stresses? Q3. Is it possible to set up, calibrate, and validate a multimodal for areas with many observation wells simultaneously, or should develop individual models be developed for each well?	It's an estimate of AET as we cnnot measure that flux directy. Yes this can be done using scripts!
19	Was that bore MB030PB01 screened into the second sandstone unit? was it confined?	Yes and yes. MB030PB01 is a measurement well in the sandy aquifer

20	Assuming you have gauged pressure transducer data, would you still consider affects form barometric pressure?	This is something that could be done, it depends on how the data is preprocessed (i.e corrected for baro pressure) or if this would be a stress in the model. Typically we don;t include the barometric pressure but it is possible
21	It's interesting - but of course the model can only be validated within the data series that you have for the input time series. So when you apply a novel series (in the example, the flood wave), is there any way to quantify the uncertainty? There must be a number of assumptions regarding function extrapolation and lack of parameter interaction that are embedded within PASTAS...	Yes, so we really need historic data, and can not introduce a new stress that was not in the calibration period.
22	Can you connect to other data sources such as snowflake to collect the data?	Could you clarify what is snowflake? Its a cloud based server/database. Interested to see how the data is connected via Pastas - does data have to be in a csv format or can you connect to an online database?
23	Its a cloud based server/database. Interested to see how the data is connected via Pastas - does data have to be in a csv format or can you connect to an online database?	Ah yes, we have connected Pastas many databases and sesrvers. as long as they run Python
24	during the course, will we be provided with example pumping data if we do not have our own complete data to use PASTAS? would it possible to follow along the course	Both, we'll provide the data but you're welcome to bring your own