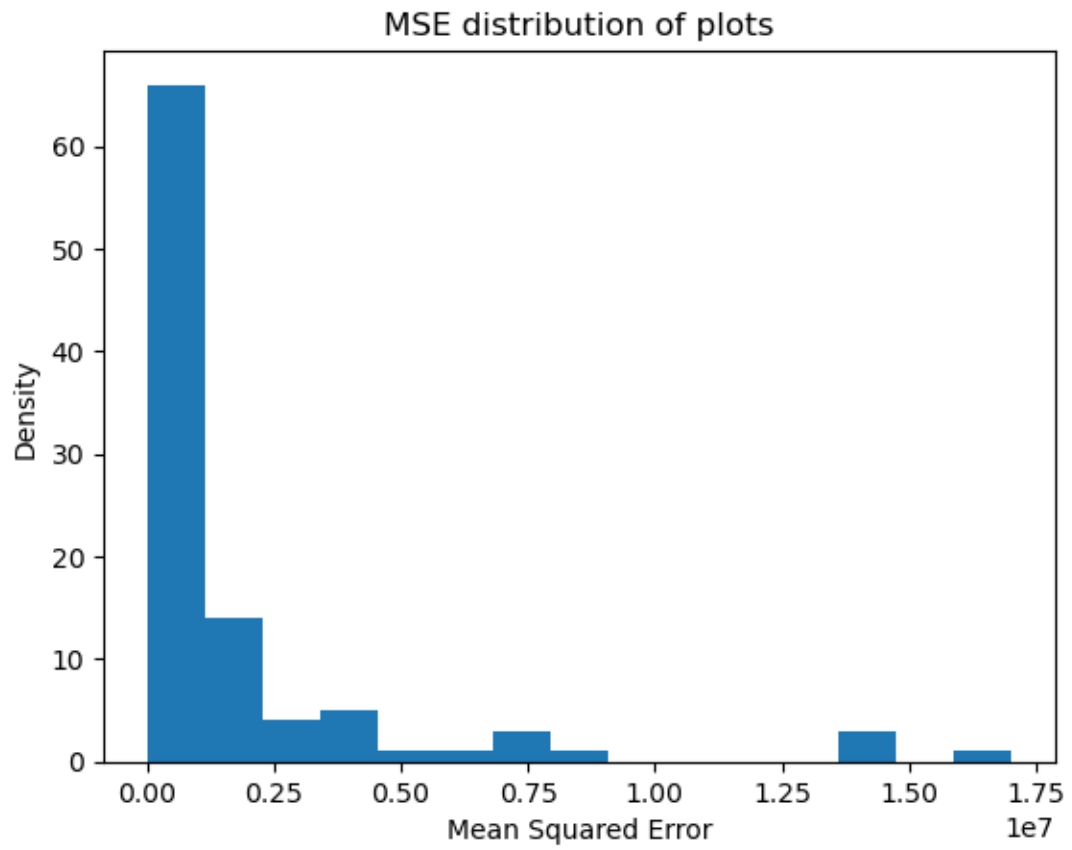


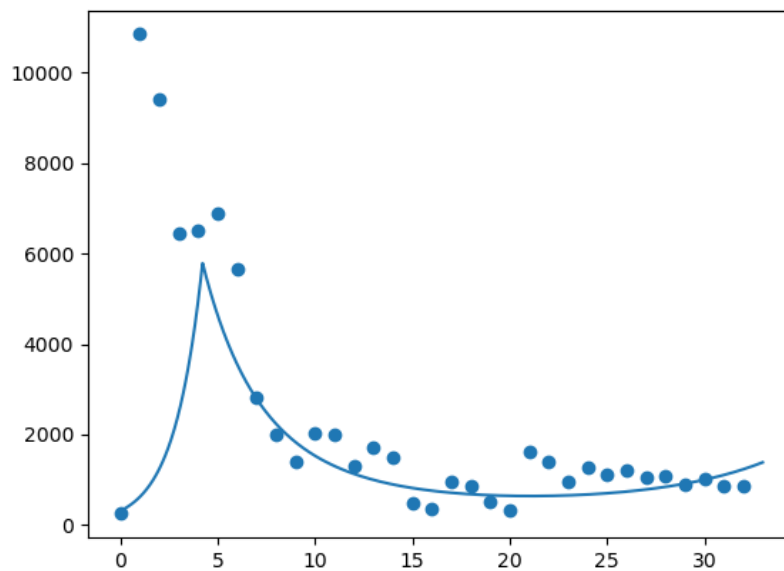
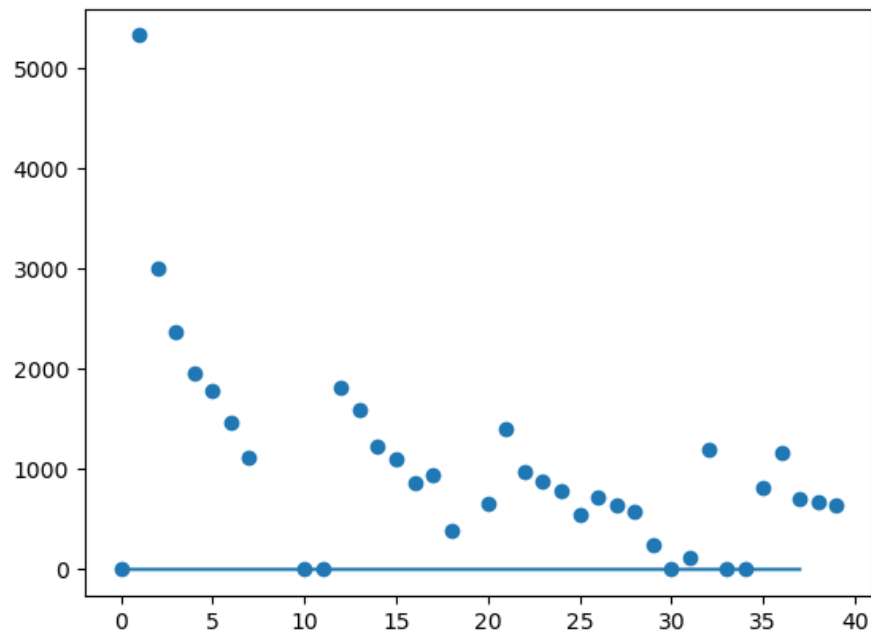
1. 461 seconds for all 100 wells



- 2.
3. In example\_fit.pdf

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4. For my loss function, I played around with MAPE, but got truly terrible plots as shown:



In the end, I decided to use MSE. Something like MAPE or MSlogE would make sense as the functions have an exponential component, but it seems that they're not properly penalizing

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when trying to fit the larger values, as there can be a large amount of near-0 values towards the end of production.

5. I struggled mightily with this and ended up unable to find a decent idea for masking outliers due to the piecewise nature of the data and the fact that we need to identify outliers prior to modelling. Obviously we could do the immoral thing and rip out high-MSE points after fitting to try and reduce error, but that would be a leakage of data.

My alternative idea was to set a moving mask where the point must not be less than 5% of the prior value or more than 200% of the prior value. This would not work in practice though, as shown in Well 3, at times the production is fairly low, then just drops to 0. This makes sense if the well is near-dry and would effectively remove many of our points.

6. I believe that MAPE or MSlogE or even  $R^2$  when log-transforming the oil production outputs would make a lot of sense. Since the functions are working at least partially in log space and otherwise in an effective inverse root space, perhaps MSE would be a good baseline metric to evaluate since we are working with a piece-wise function for the flowrates.

Apologies for not being able to properly implement the last few points in a better manner. You can see that I have the loss function as its own separate parameter in the code so that I could easily change it to validate it as a hyperparameter. Unfortunately, my outlier detection was poorly thought out and I was unable to find or come up with a strong algorithm to handle piece-wise time series outlier detection when the location of the discontinuity is not known ahead of time either.