DA for naturally fractured reservoir

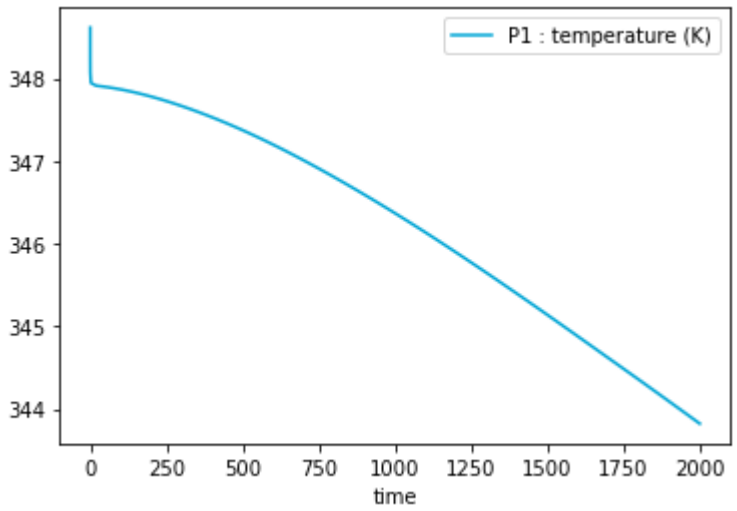
Date	@July 6, 2022
Note Type	Research
One Line Summary	Preliminary results of the ES-MDA application on the naturally fractured reservoir model provided by Stephan

Summary

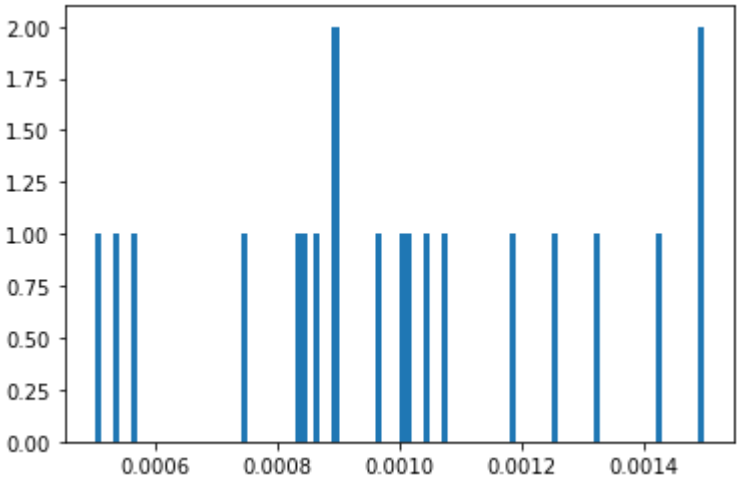
In this experiment we used a geothermal reservoir model with fractures and considered the fracture aperture as the main uncertainty.

Reference Model

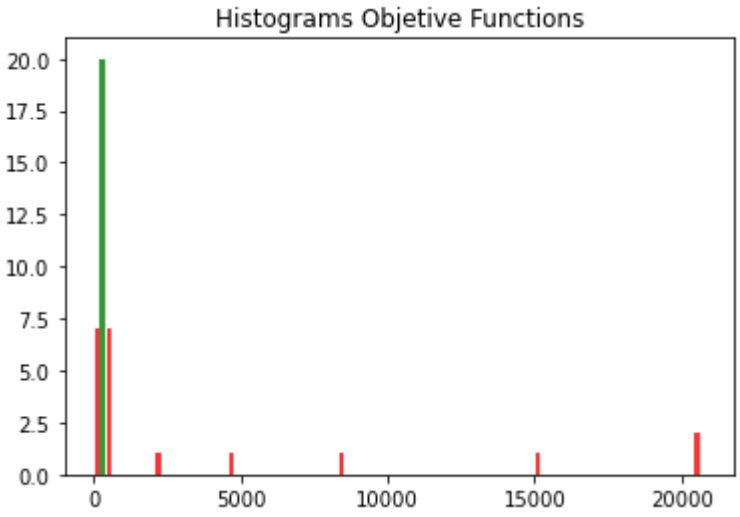
For the reference model, a fracture aperture of 0.001 m was considered and the final temperature of the producer is:



For the prior distribution of the fracture aperture was considered a normal distribution in the following format: (Em_frac_aper = np.clip(np.random.normal(1e-3, 0.5*(1e-3), Ne),0.0005,0.0015))

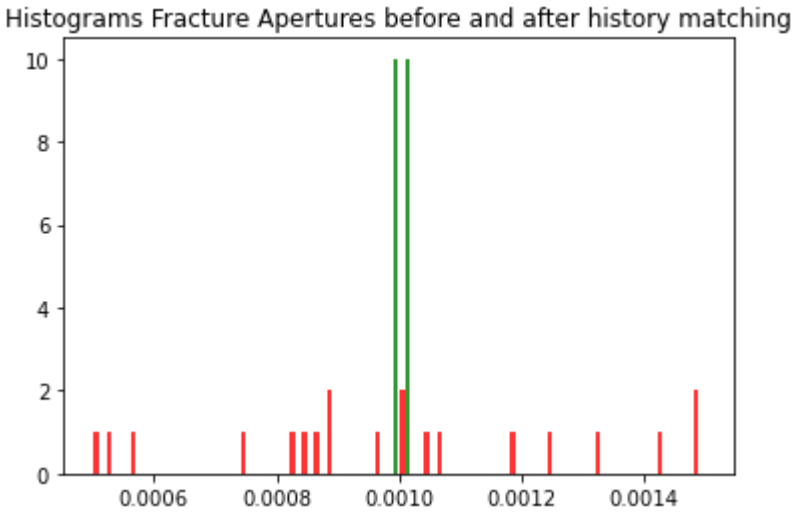


It took 20 minutes to run the 20 simulations (4 times each - ESMDA, considering alpha = 4) and the results are:



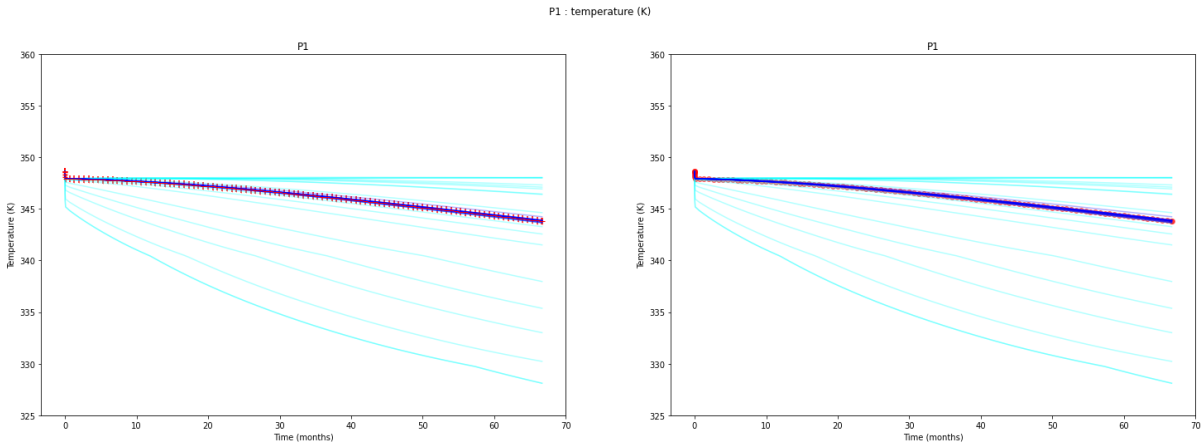
Prior objective function (red) and posterior objective function (green)

A comparison of the fracture aperture distribution of the prior and the post



Prior objective function (red) and posterior objective function (green)

The bottom hole temperature of P1 is shown on the figures bellow - leftwith the error on the mesurements and left without the error in the figure)



Temperature for P1 on the prior models in light blue, for the posterior models in dark blue and the reference data in red

Final Comments

As the prior distribution of the fracture aperture was a Gaussian and the values were kept between 0.0005 and 0.0015, while the reference value is 0.001, the final result of the history matching showed very good results.

This limit was considered because when a wider range was used for the fracture aperture, some simulations had problems to finish (probably the ones with very low frac_aperture) and the processed could not go until the end.