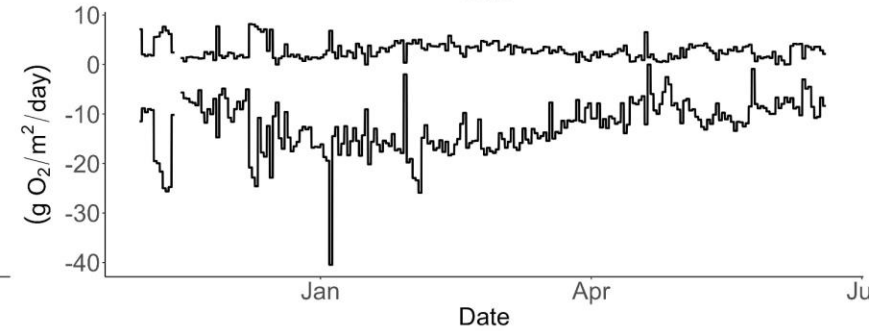
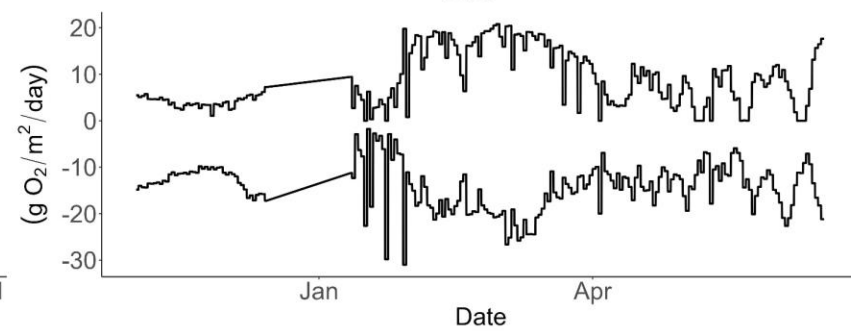
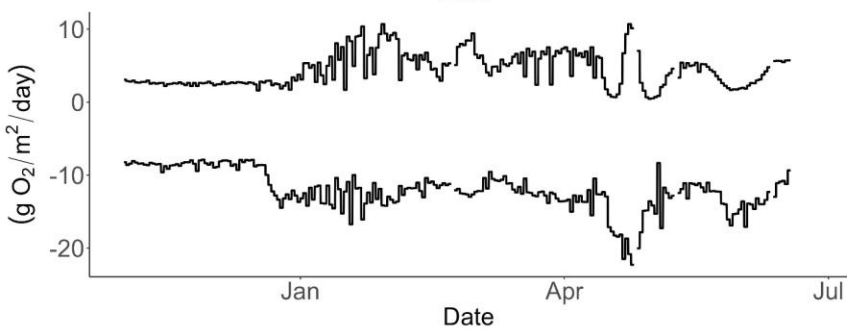
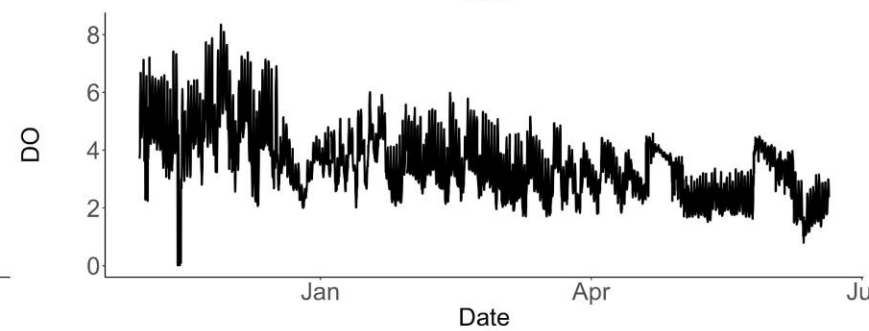
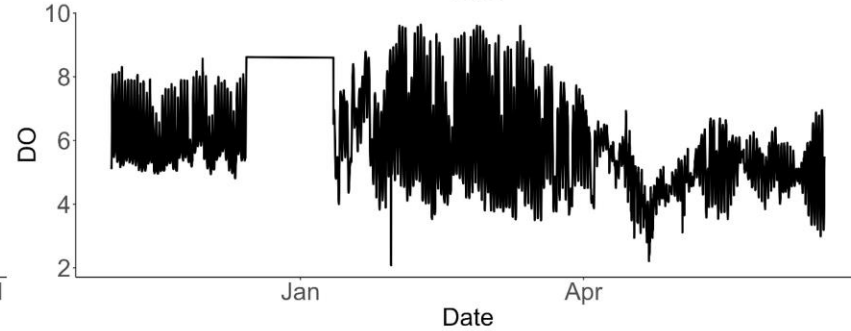
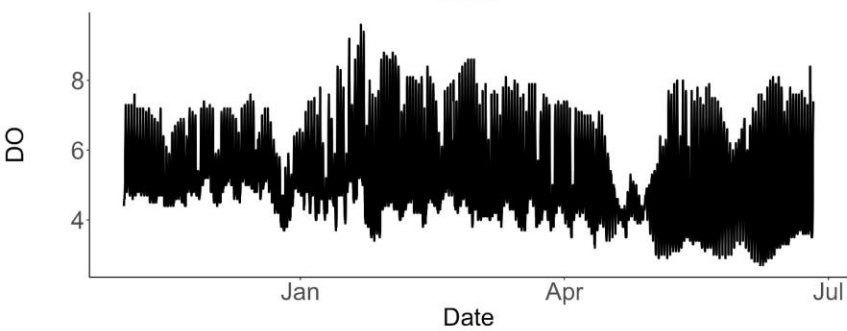
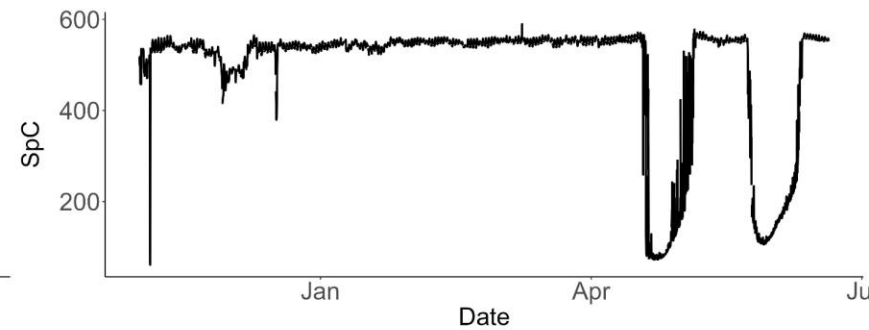
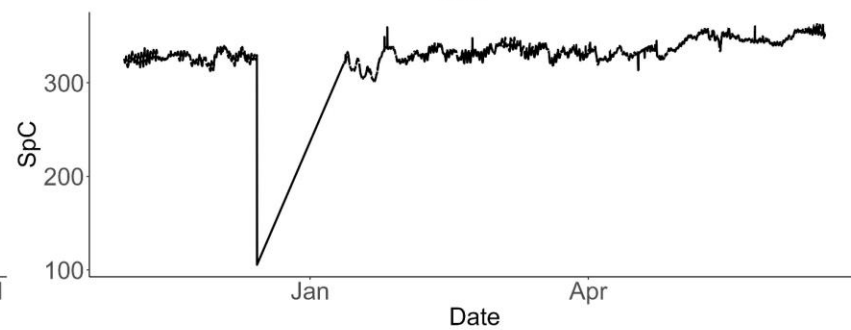
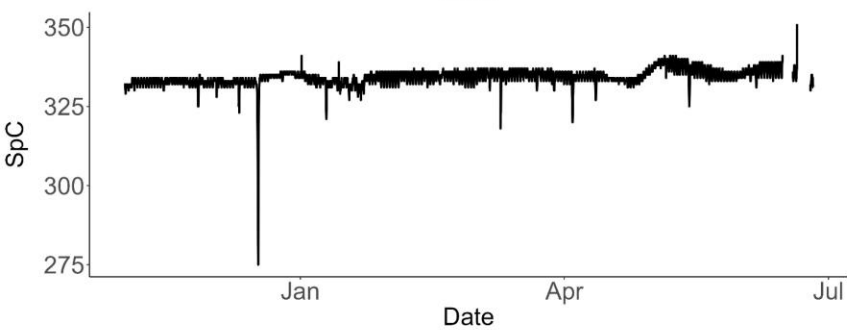
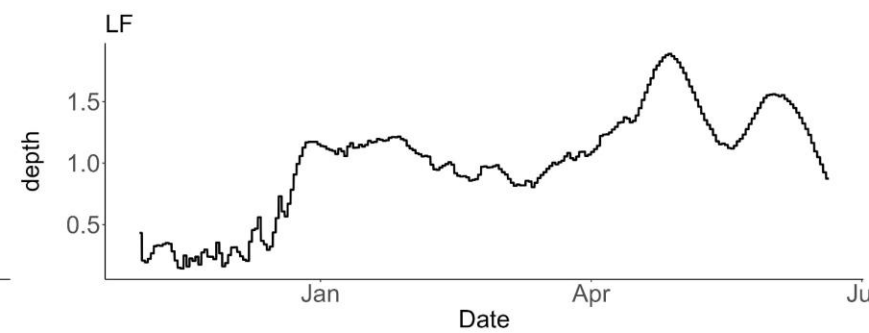
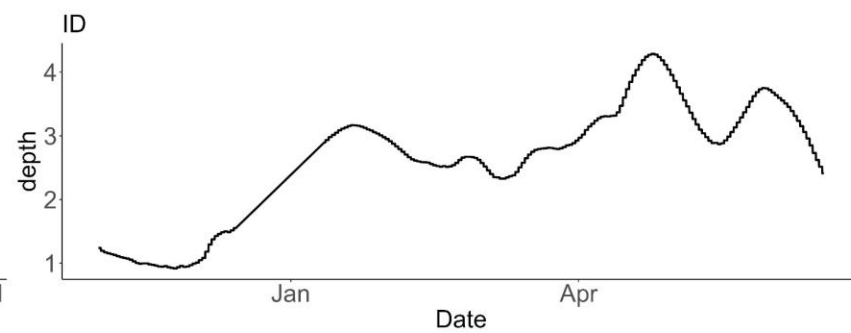
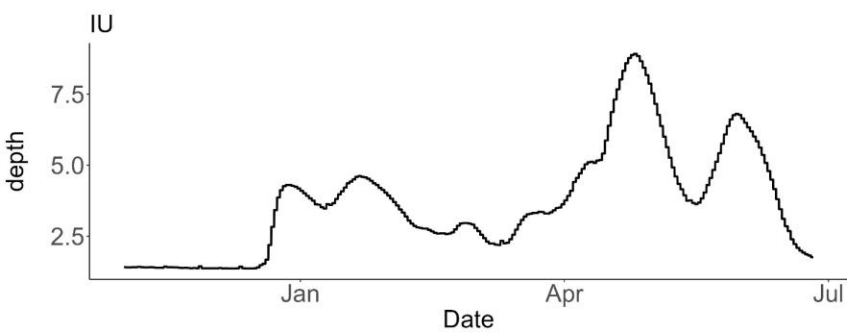
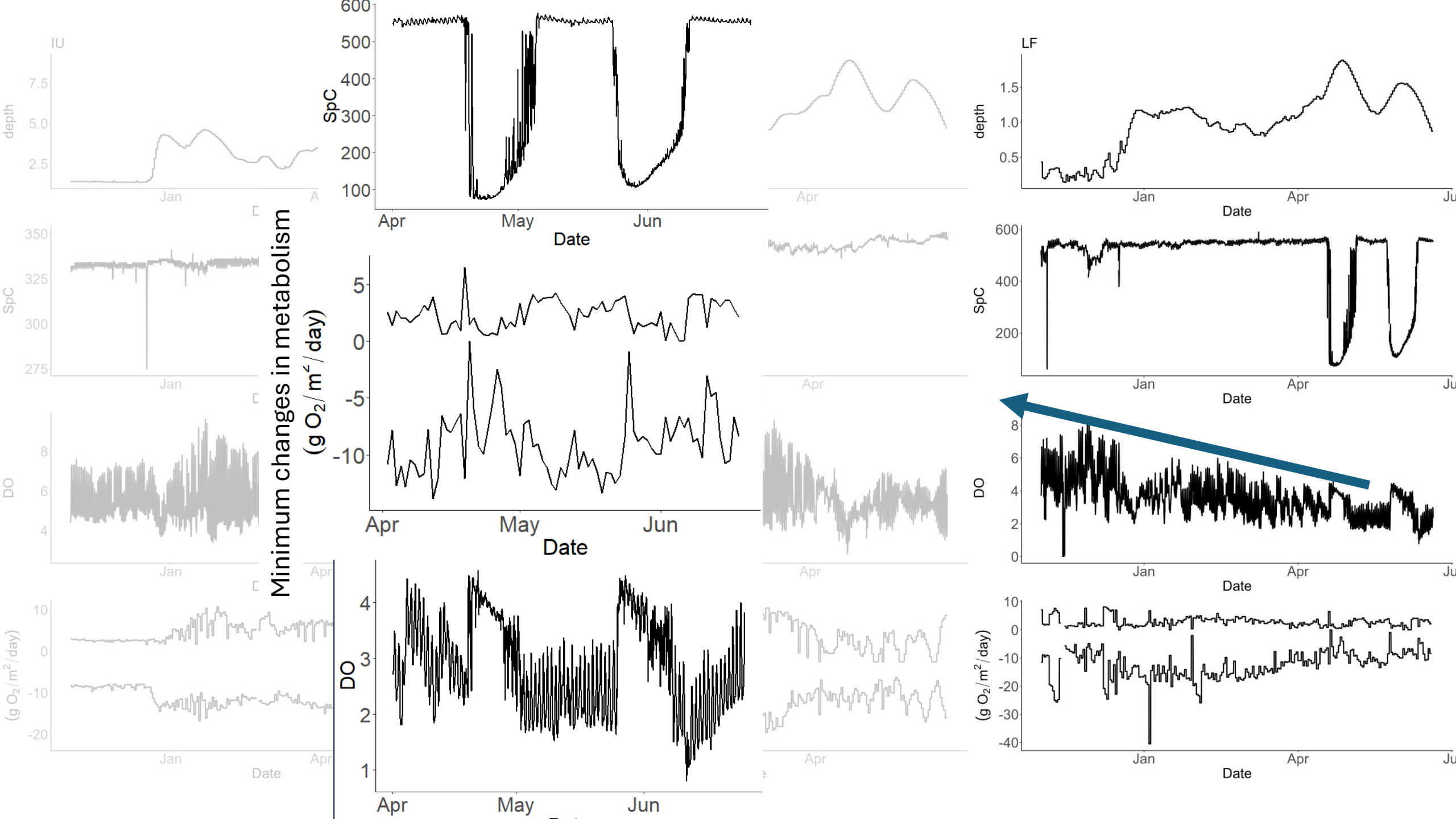


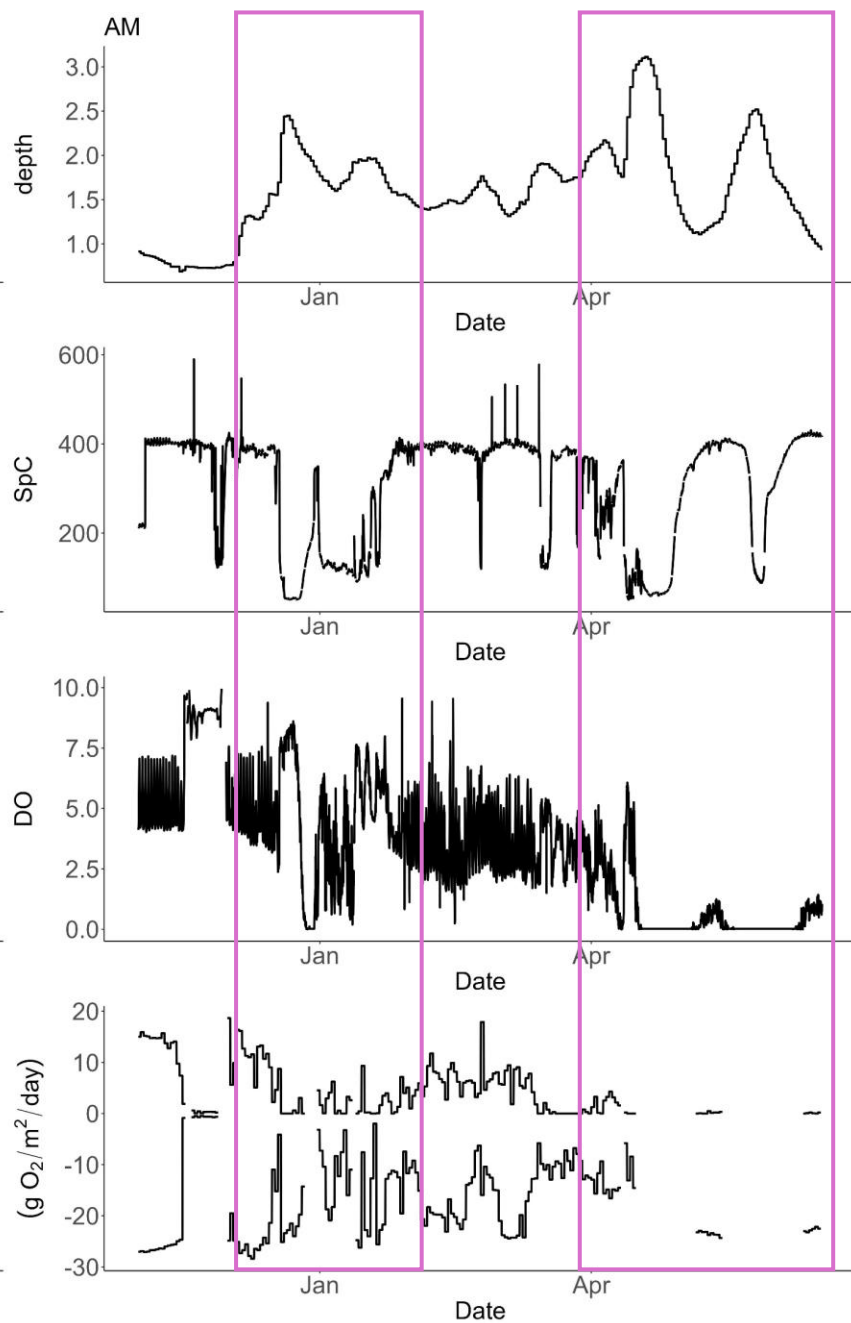
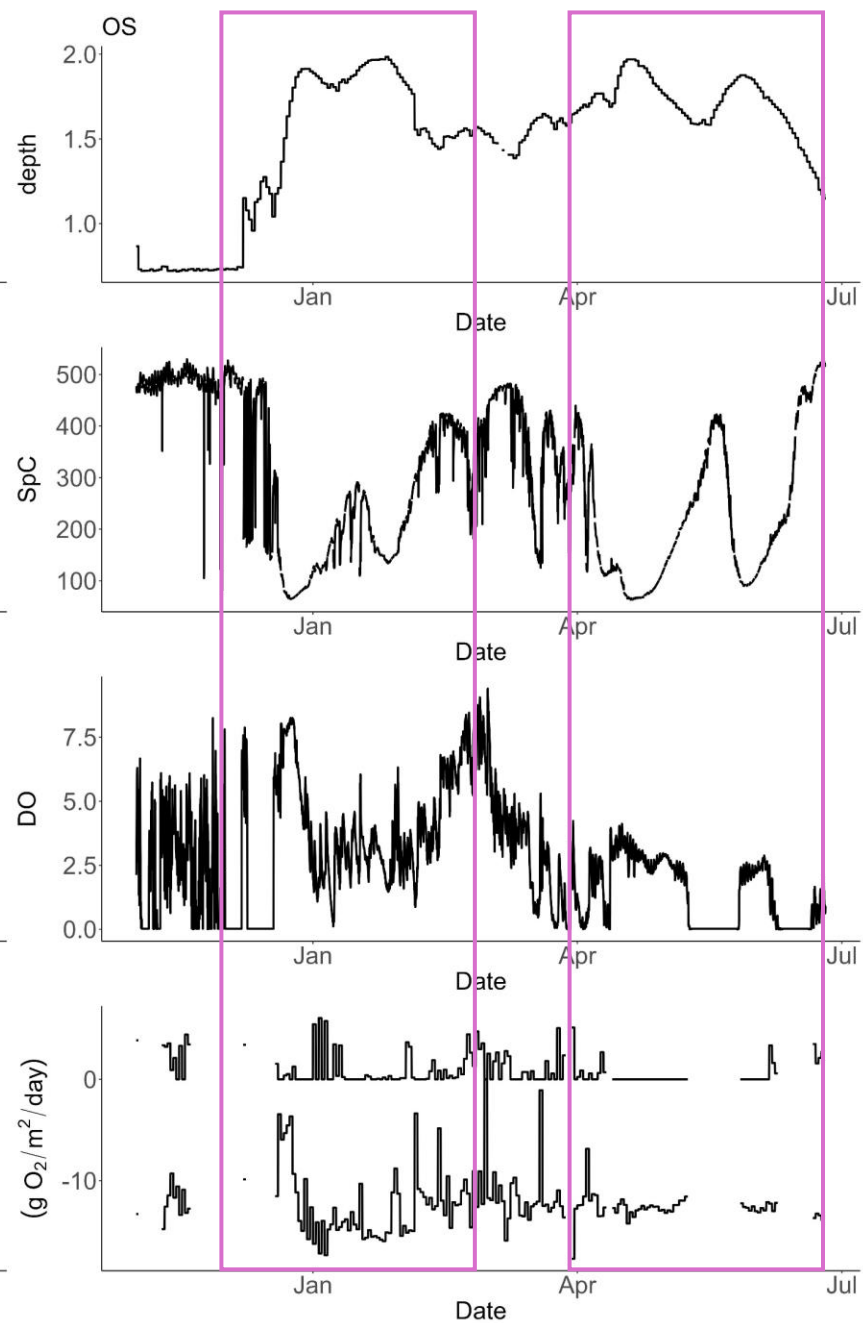
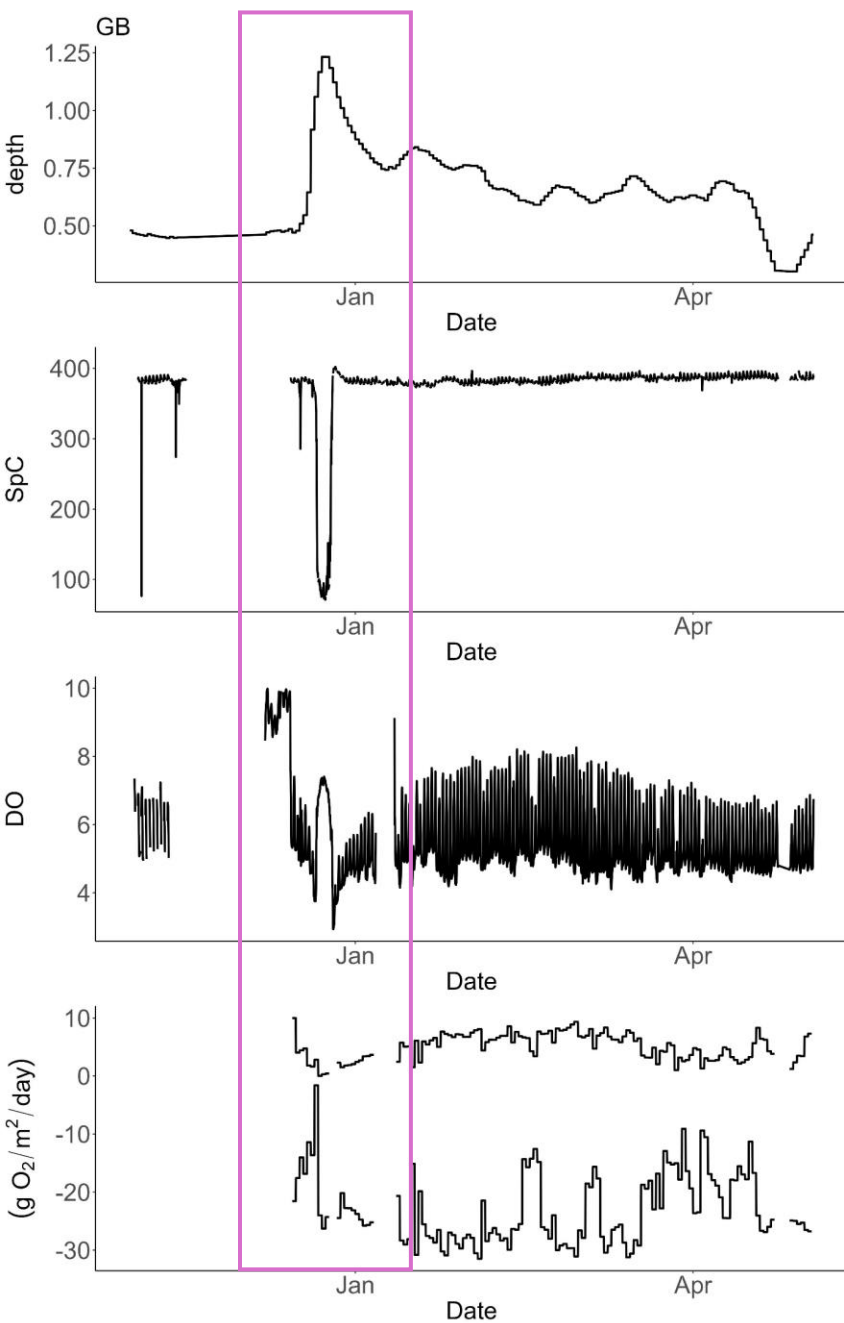
# Spring RR Project

Sam Howley, 06/26/2024

\*These figures are not publication ready!!



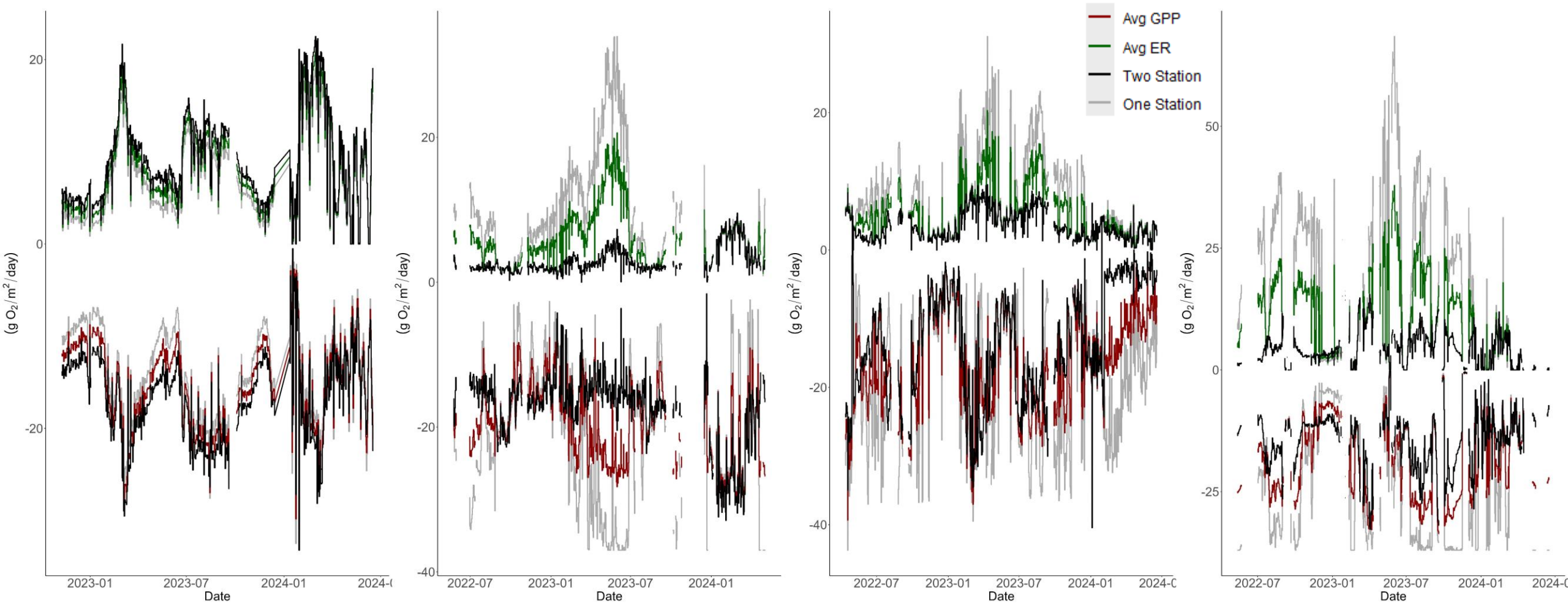




DO out of range; reads -0.02 for missing SM data

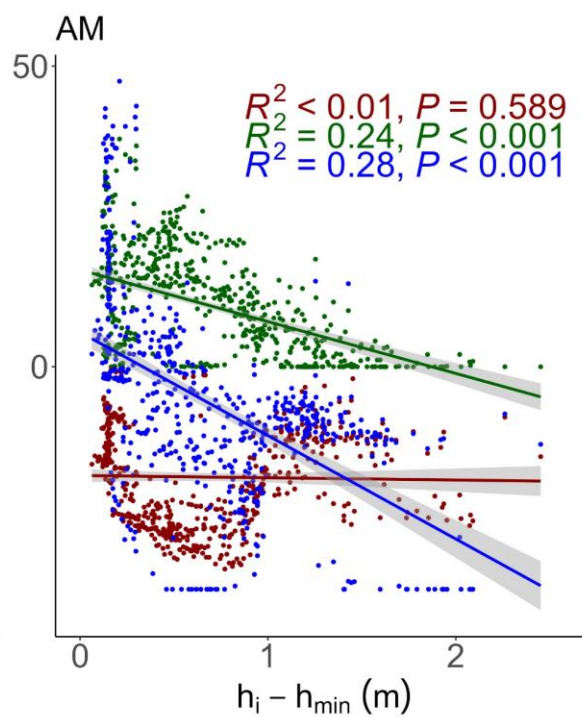
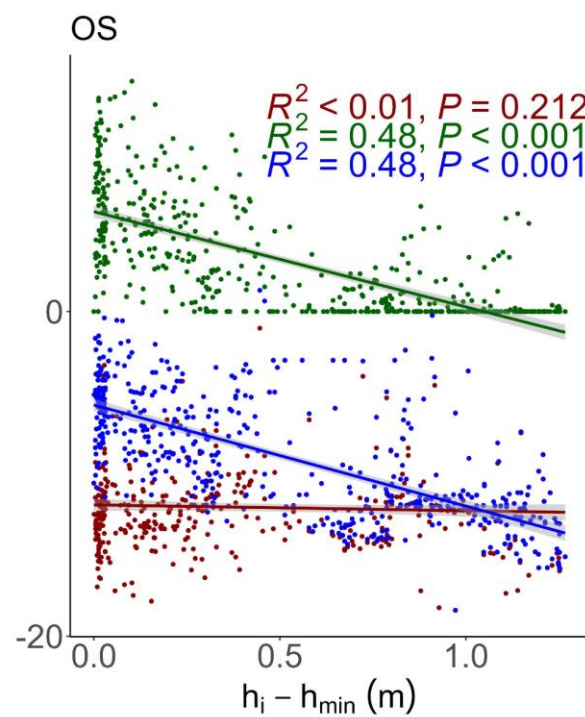
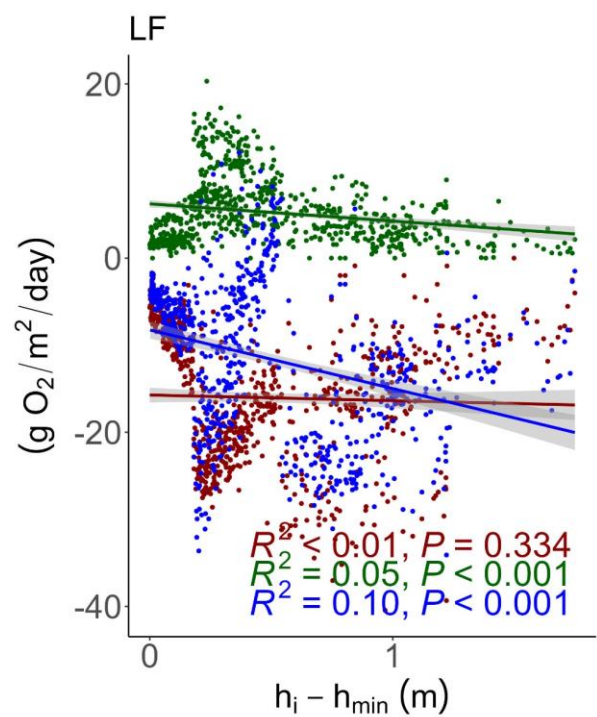
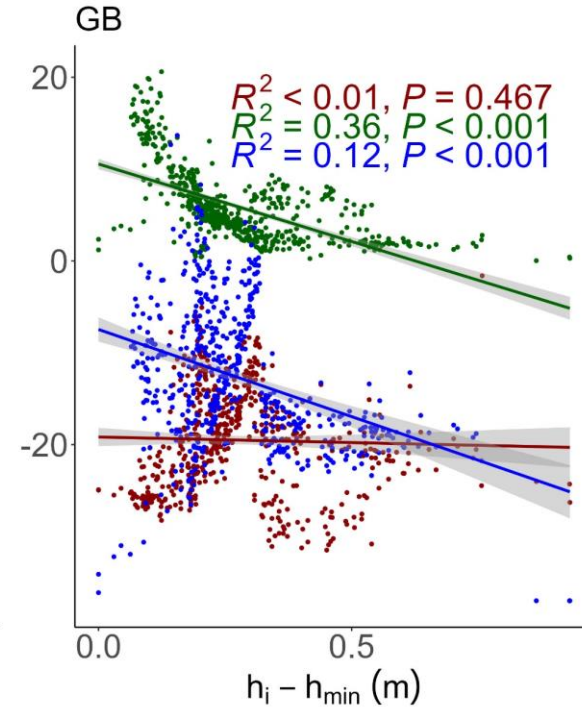
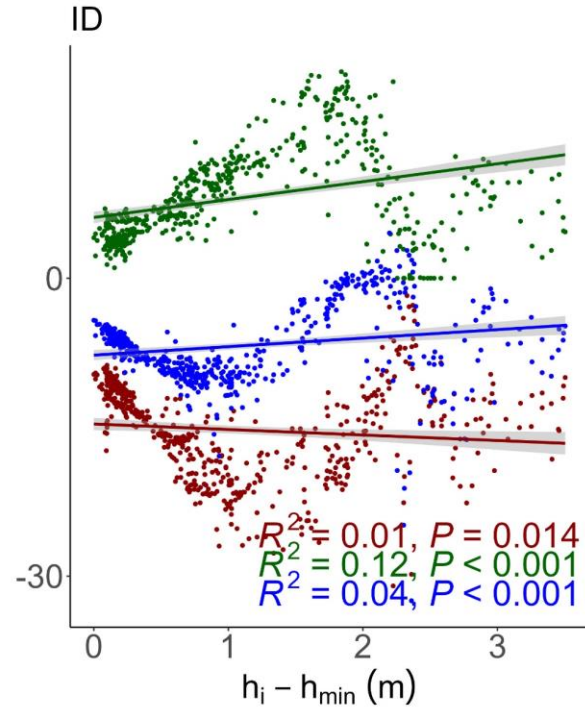
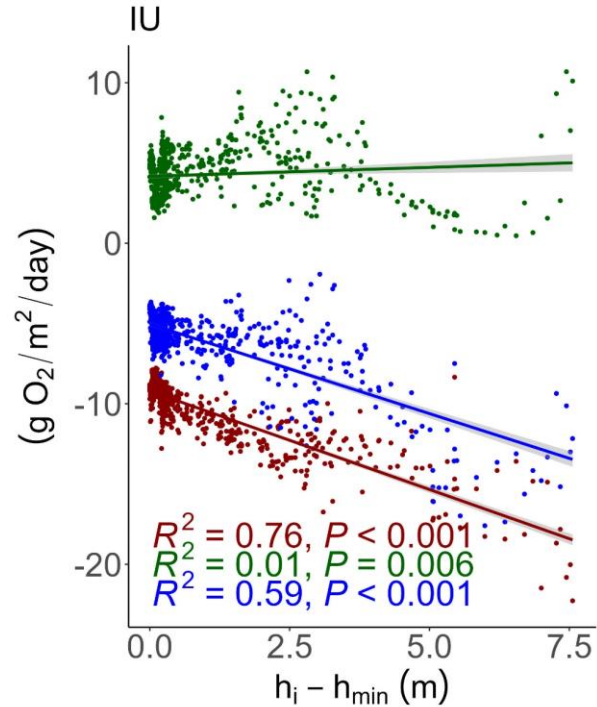
Site	Mean Stage (m)	Mean Reach (m)	Mean Discharge (m <sup>3</sup> day <sup>-1</sup> )	Study Period	h <sub>high</sub>	h <sub>brown</sub>	h <sub>reversal</sub>	Total floods	Recorded floods
IU	1.1	4950	303	07/20/2023-06/20/2024	3	0	0	3	3
ID	1.2	2900	668	07/20/2023-06/20/2024	5	0	0	5	5
GB	0.5	350	141	07/10/2022-06/20/2024	3	1	2	5	4
LF	0.5	320	58	07/12/2022-06/25/2024	4	1	1	6	3
OS	1.0	1350	165	07/20/2022--6/25/2024	4	4	1	9	8
AM	1.4	1000	516	07/20/2023-06/20/2024	6	5	2	13	13

To “smooth” the transition between one and two station, I took the average between one and two results.

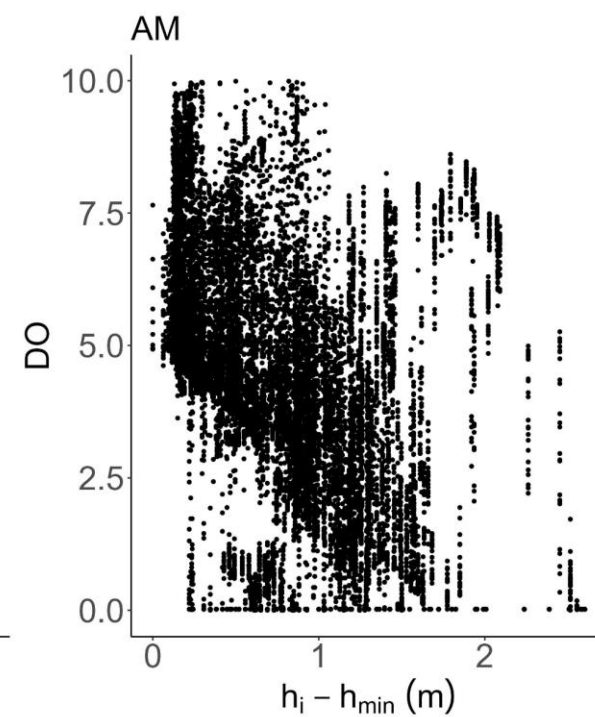
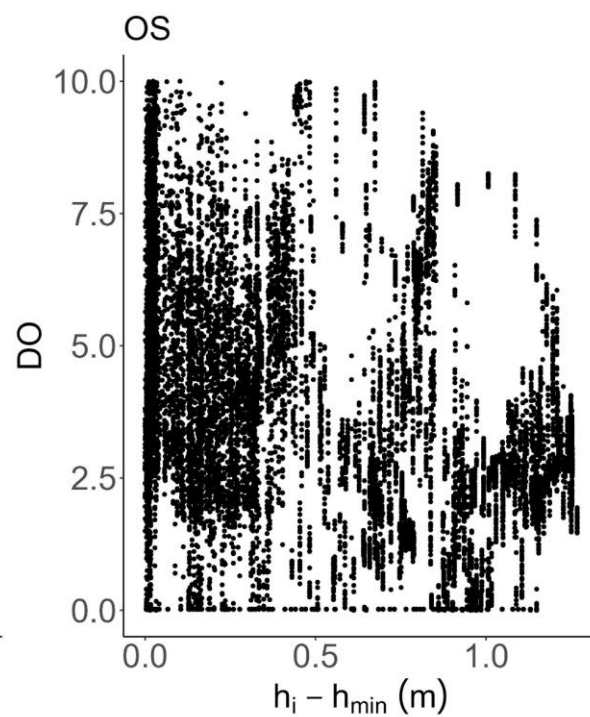
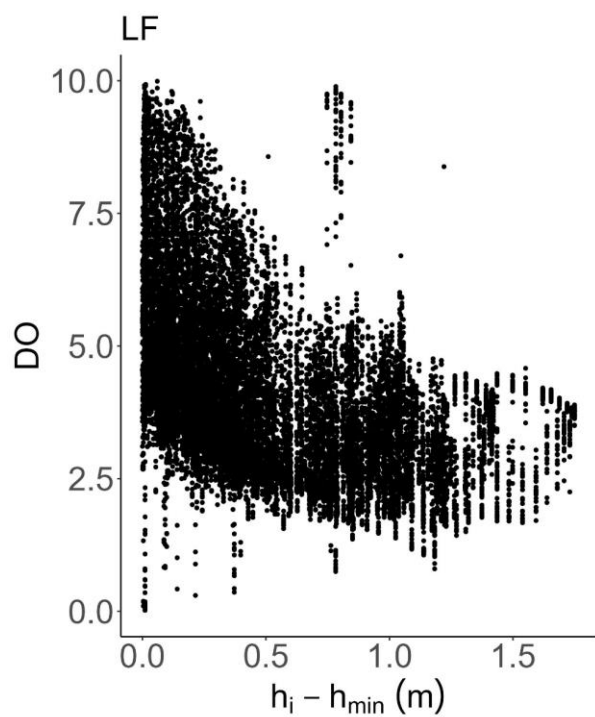
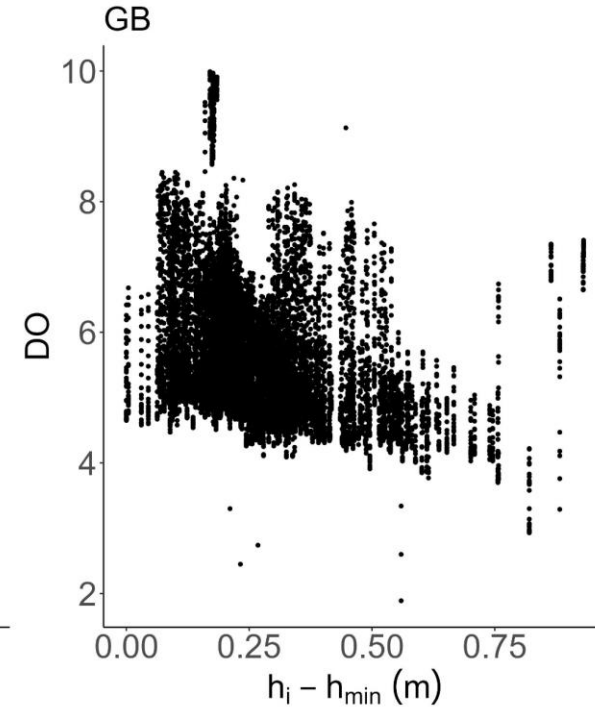
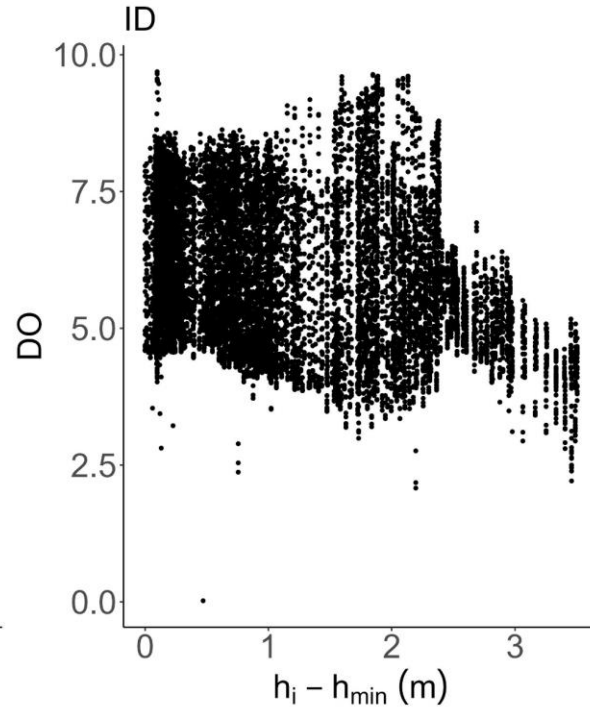
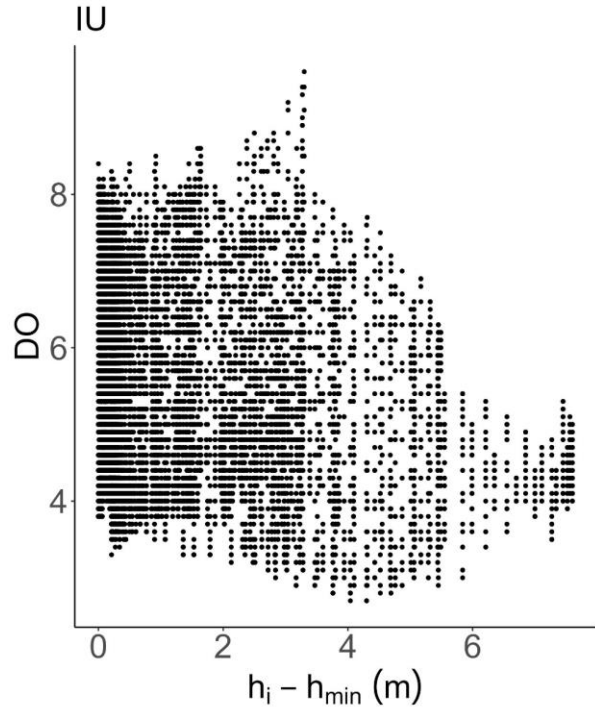


Low-stage metabolism between 1 and 2 are similar. Larger differences during disturbances.



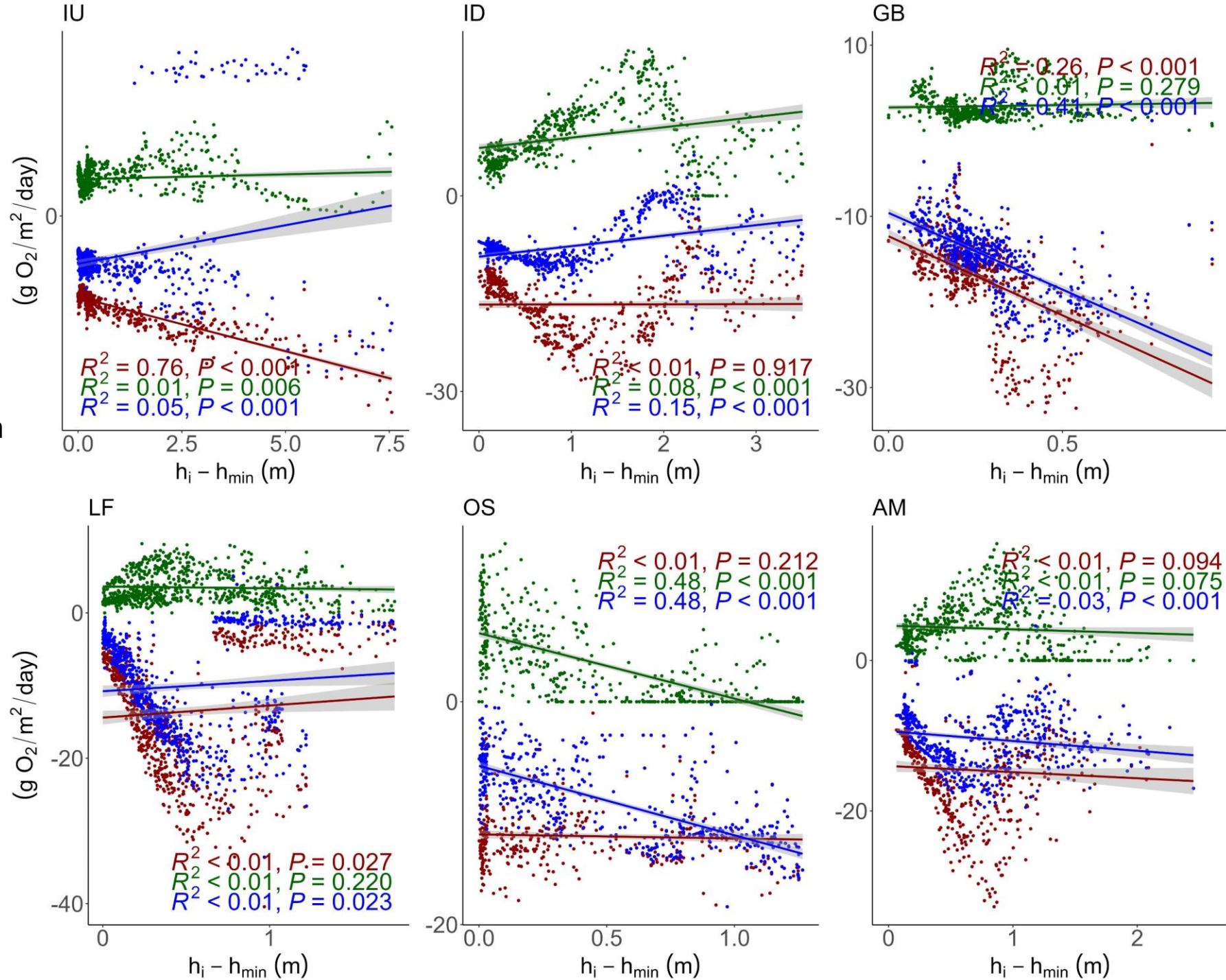


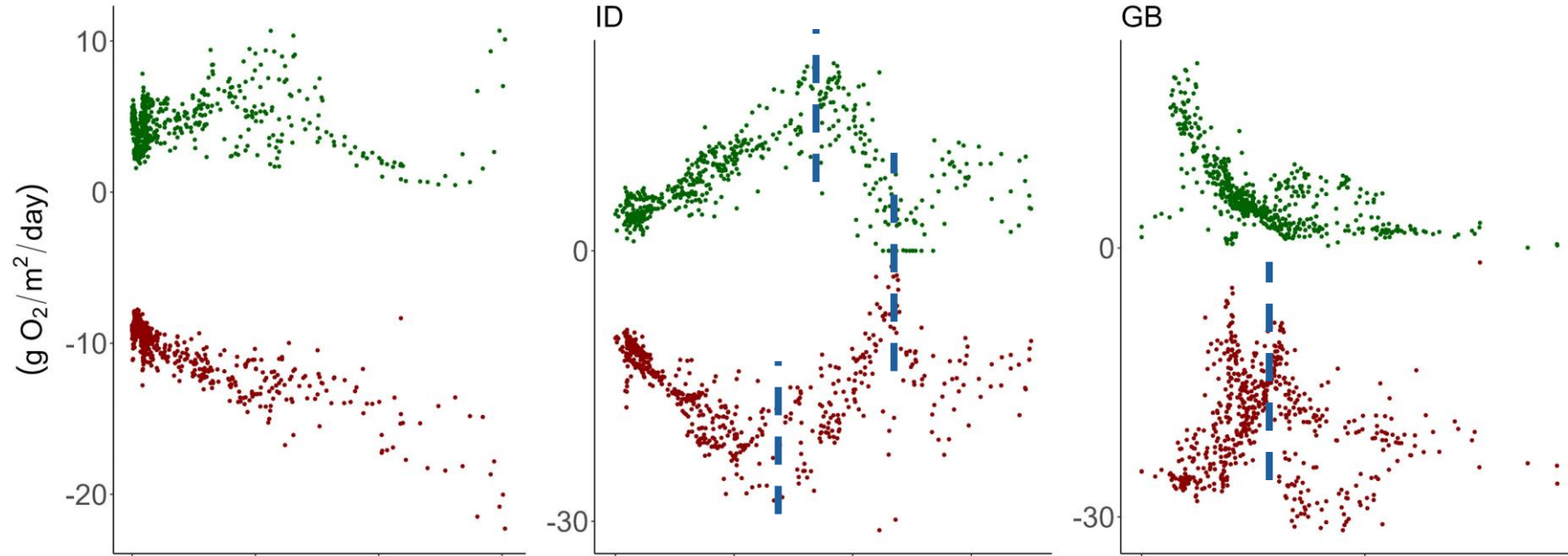
For  
reference...



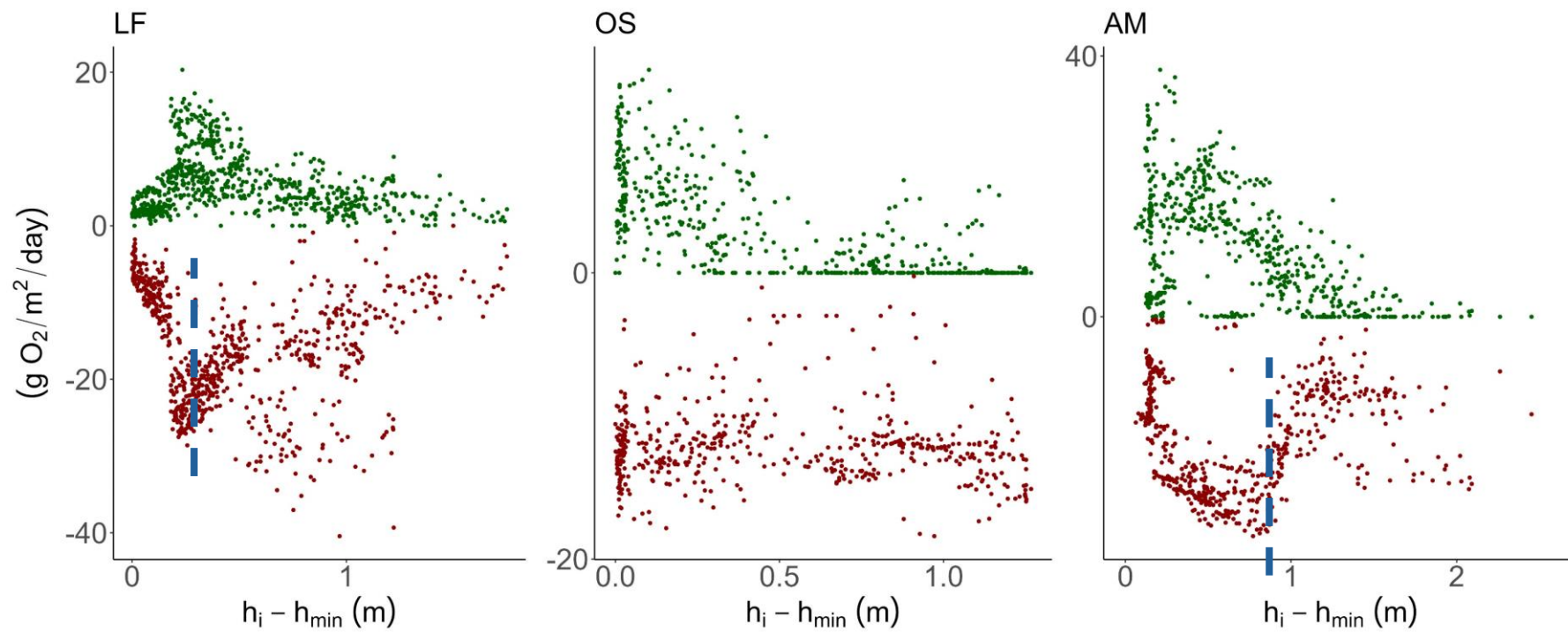


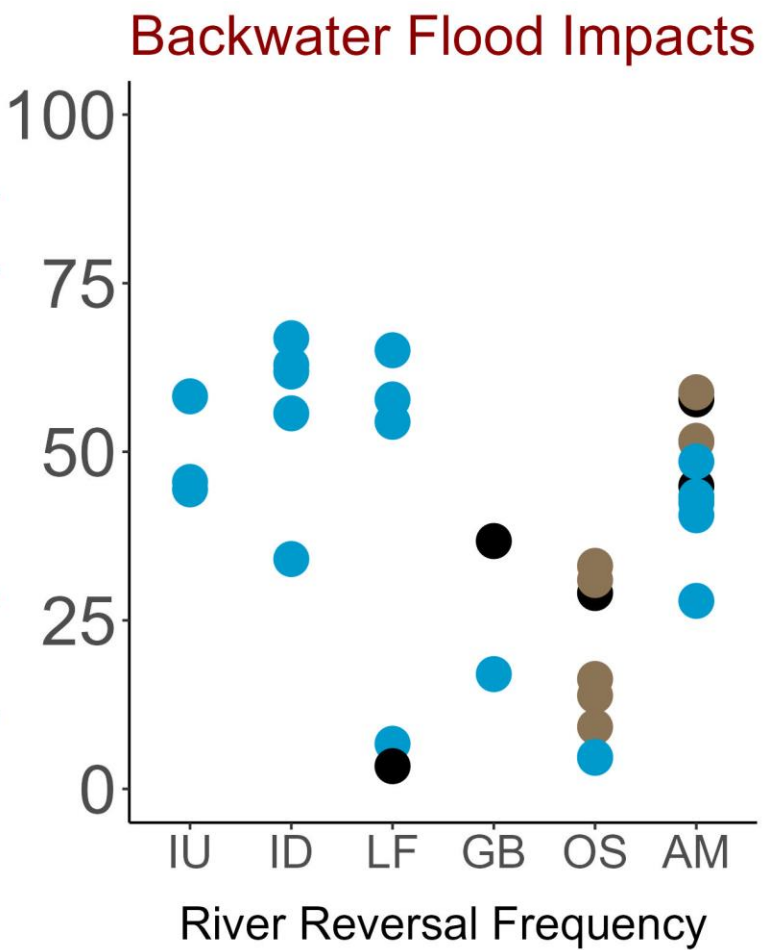
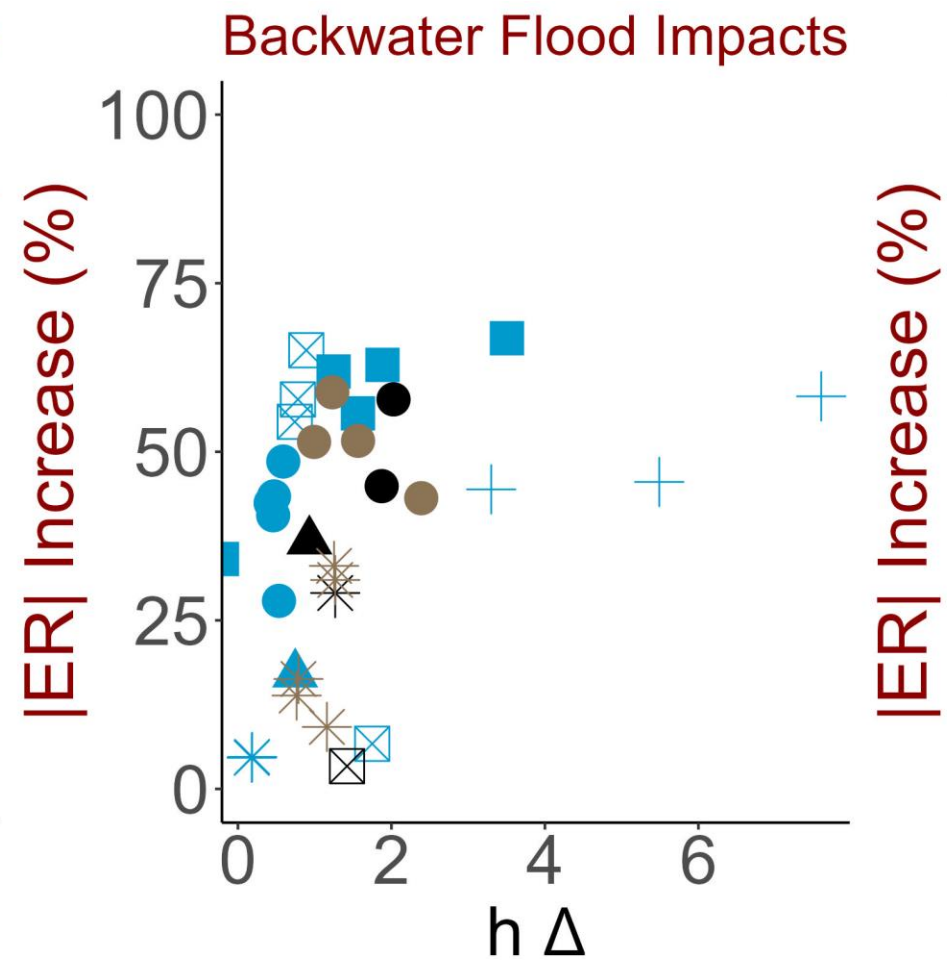
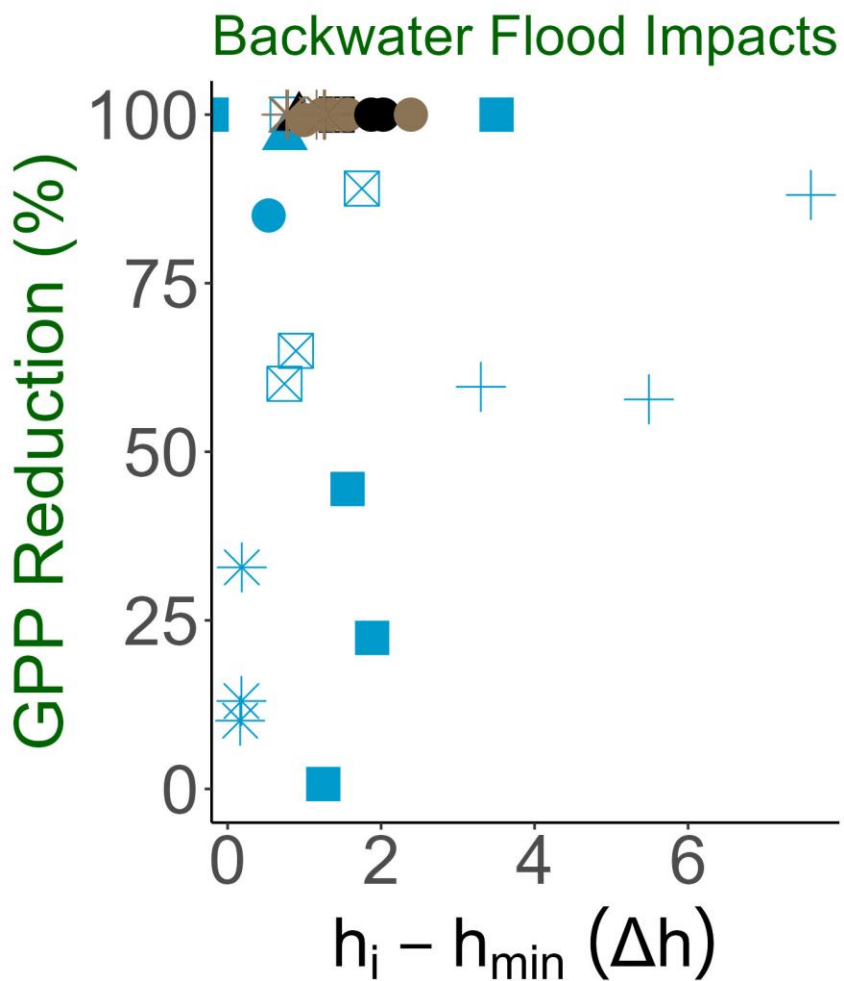
...One station  
result.





There seems to be breakpoints, especially with ER

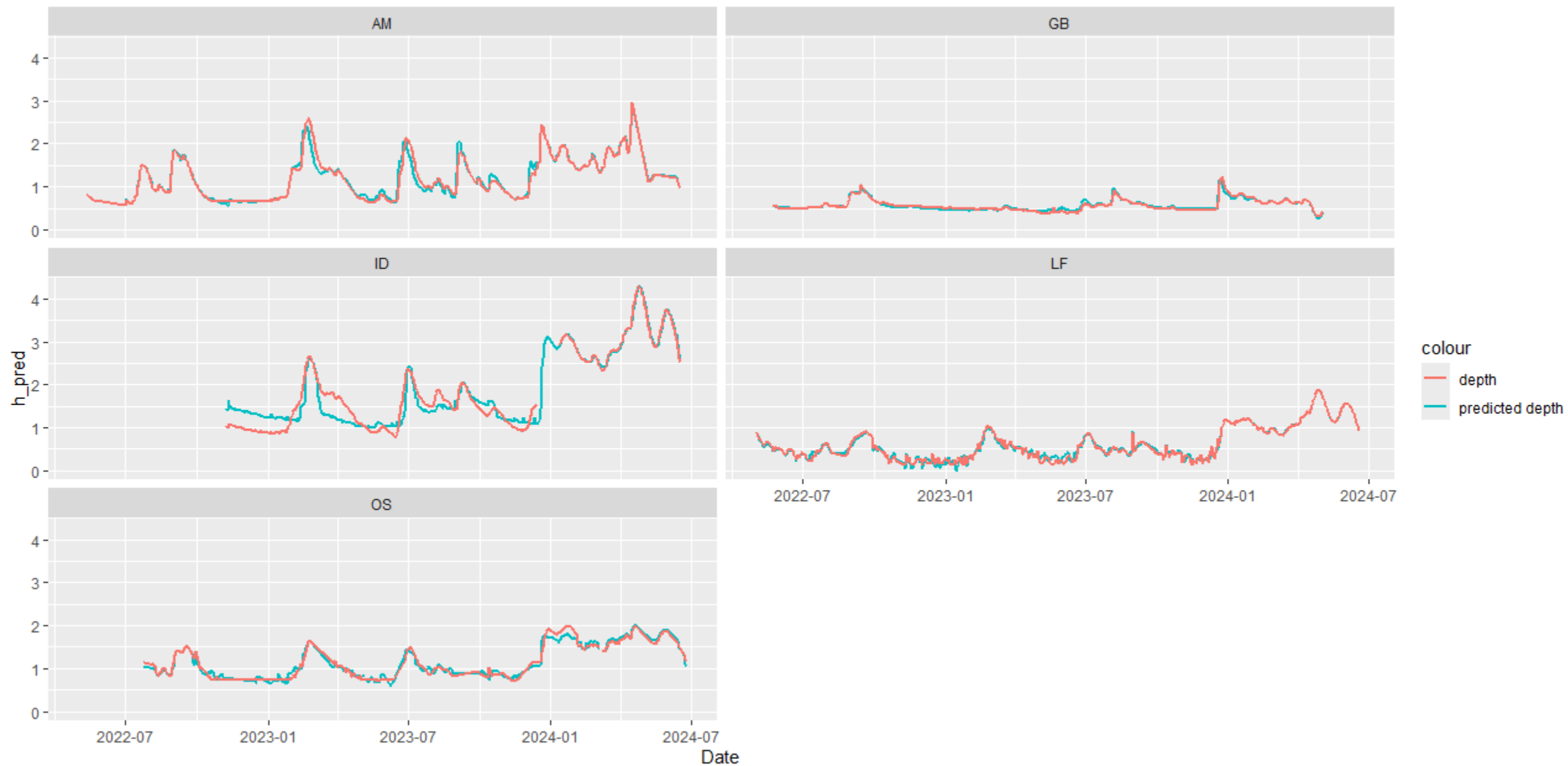




# Workflow for estimating historical stage

1. Locate two USGS river gages upstream and downstream of spring confluence
2. Calculate the “elevation proportion” ( $x$  from spring upstream gage/  $x$  from upstream to downstream gage)
3. Estimate the elevation of the river at the spring's confluence for the observed study period
4. Find relationship between estimated elevation and observed depth
5. Estimate elevation for all available data from the two gages
6. Apply depth ~ elevation relationship for predicted historical stage

# Predicted depth

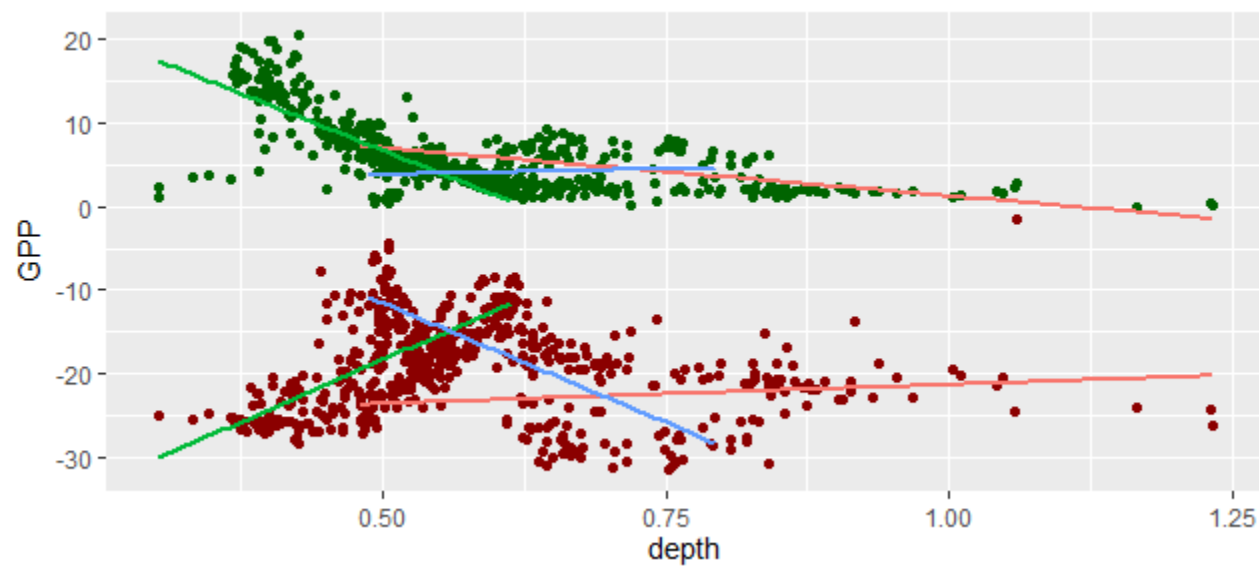




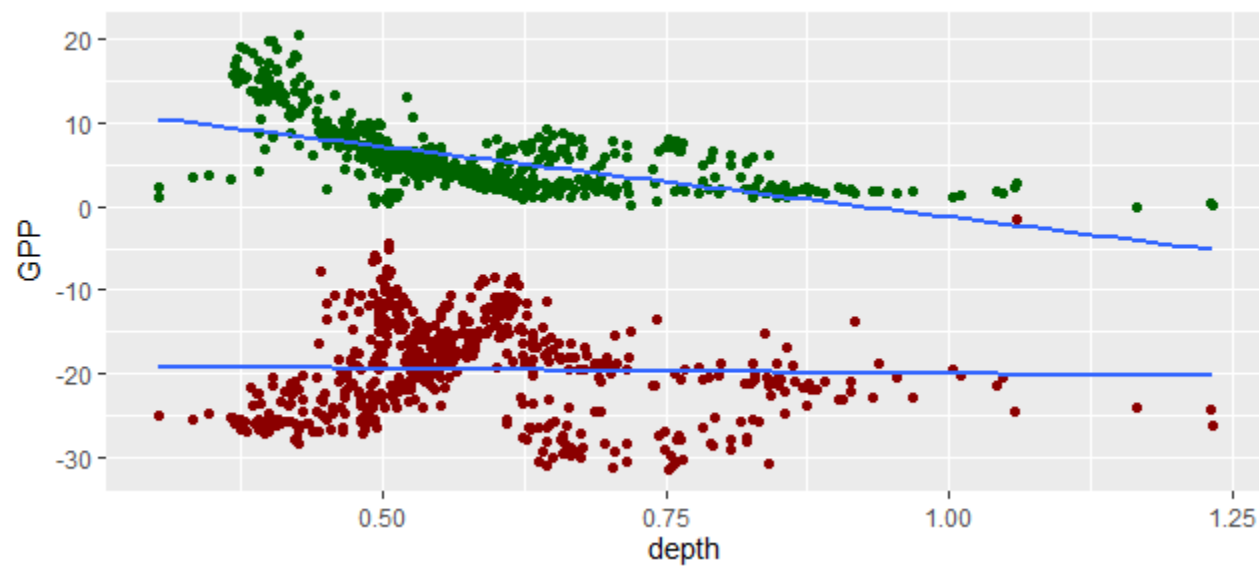
# Workflow for predicting metabolism

- Find relationship between GPP and ER, and depth
  - Lm, lm with interaction,  $x^2$ ,  $x^2$  with interaction
    - Interaction: depth category (high, moderate, low)
- Apply GPP or ER  $\sim$  depth to predicted depth

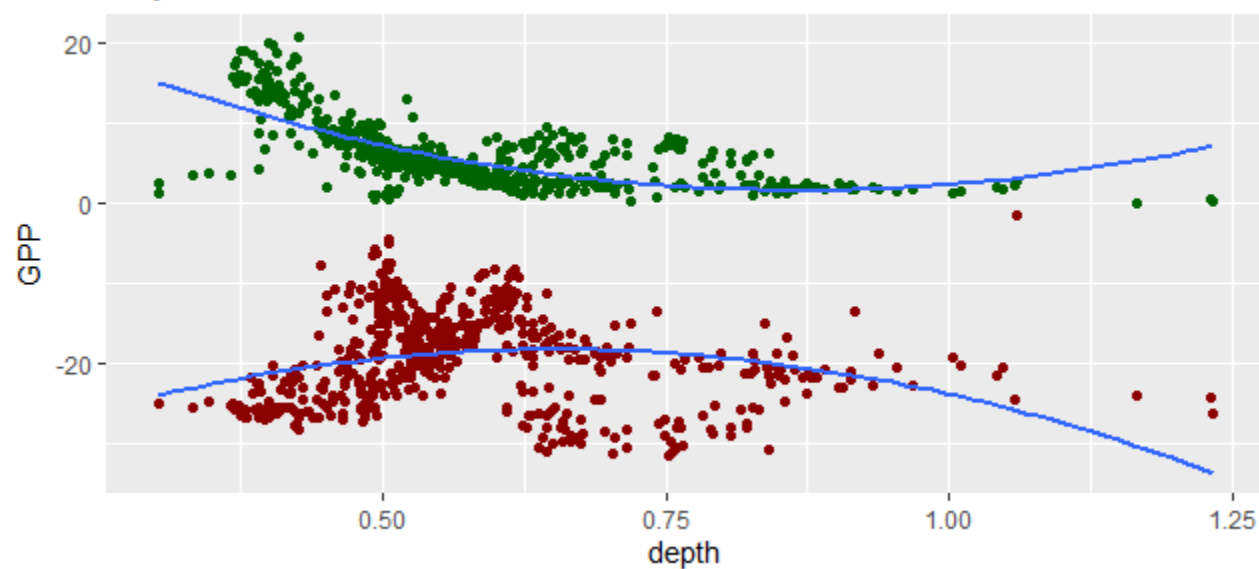
GB, linear model



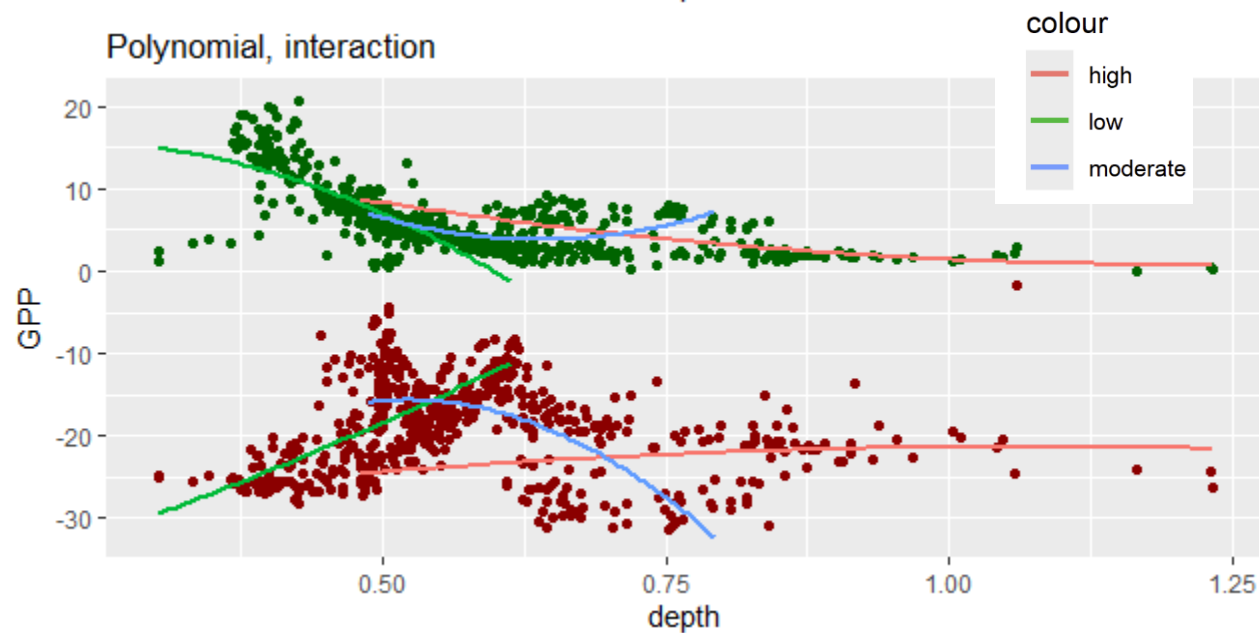
GB, linear model, interaction



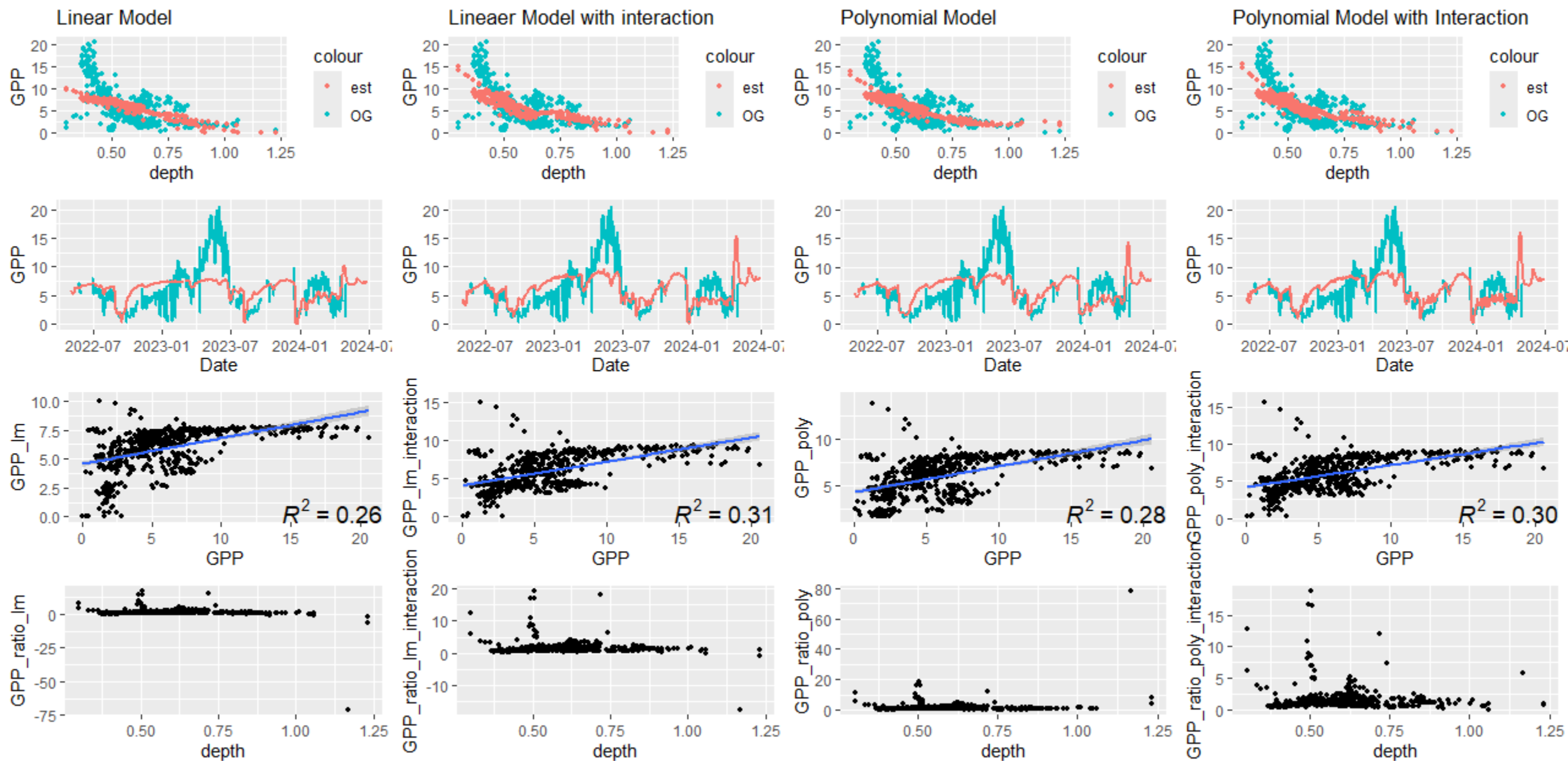
Polynomial



Polynomial, interaction

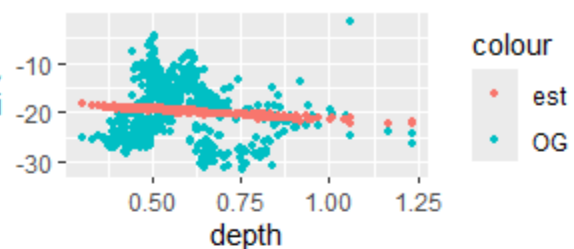


# GB

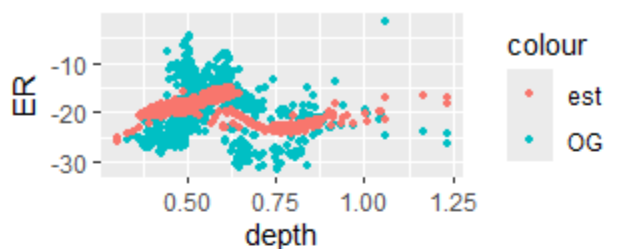


# GB

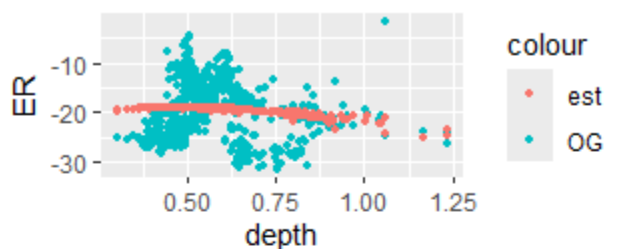
Linear Model



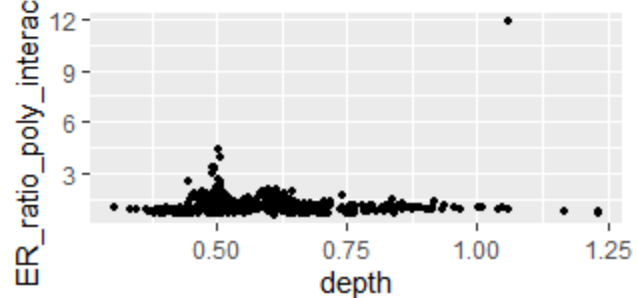
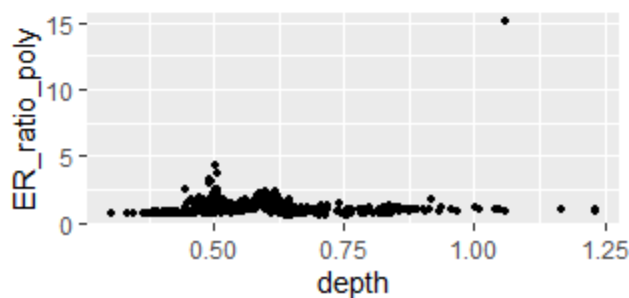
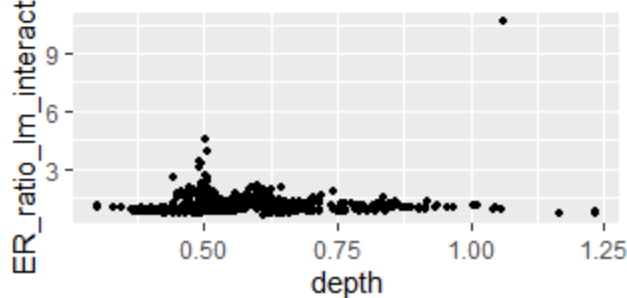
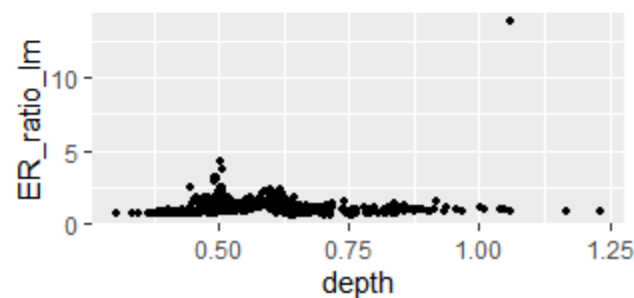
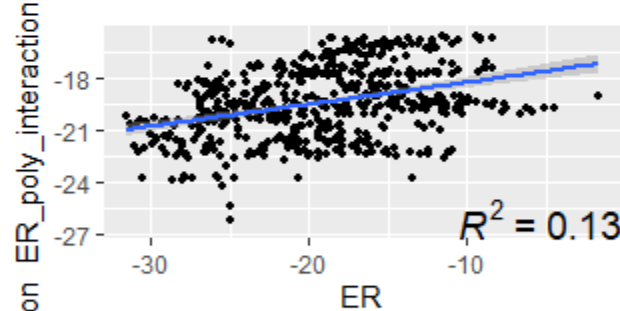
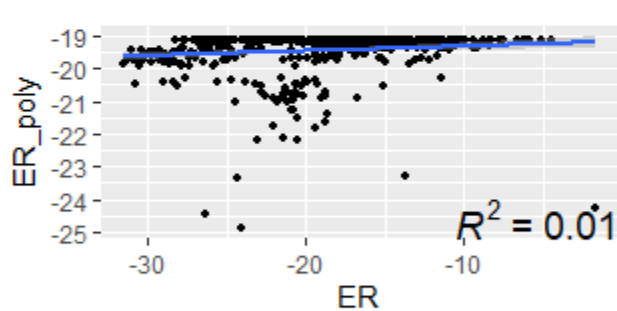
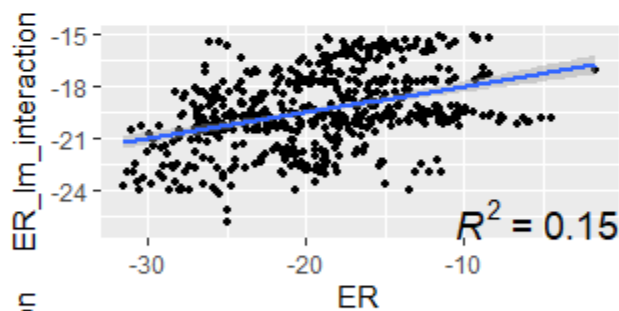
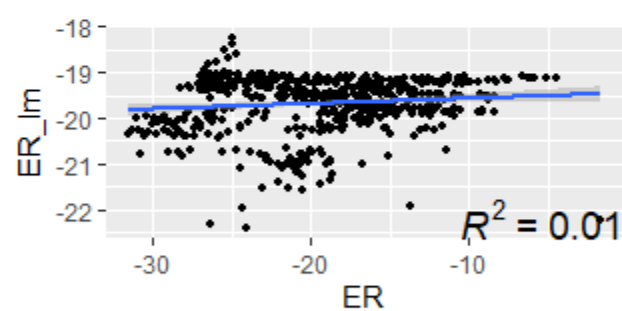
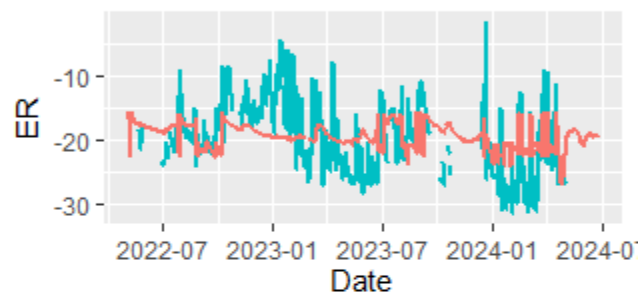
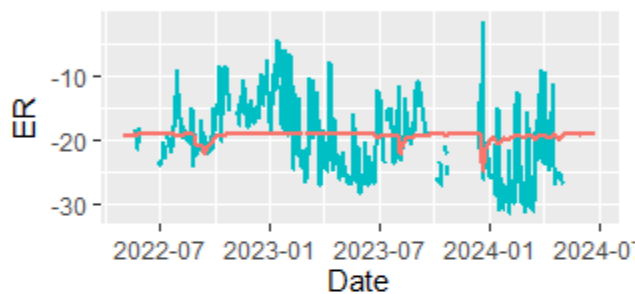
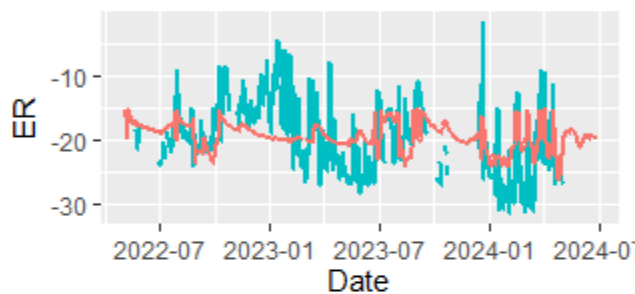
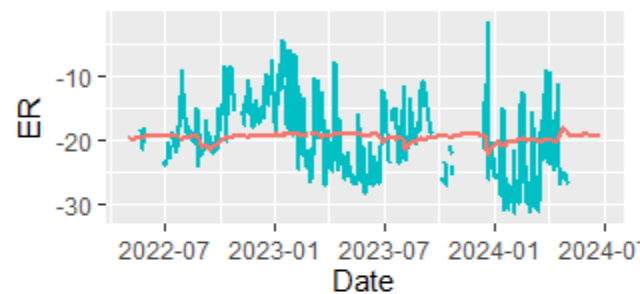
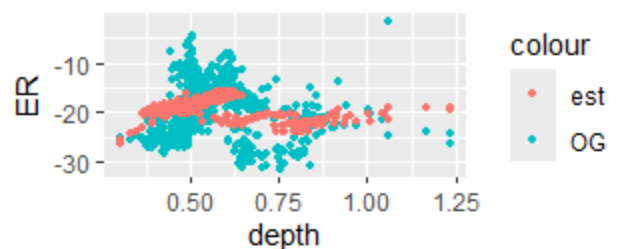
Lineaer Model with interaction



Polynomial Model

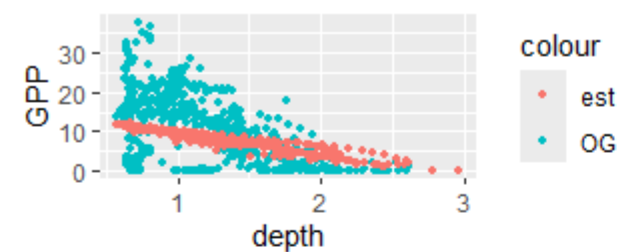


Polynomial Model with Interaction

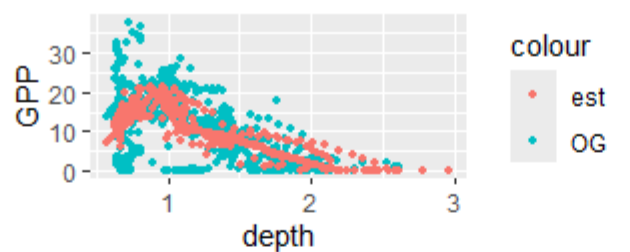


# AM

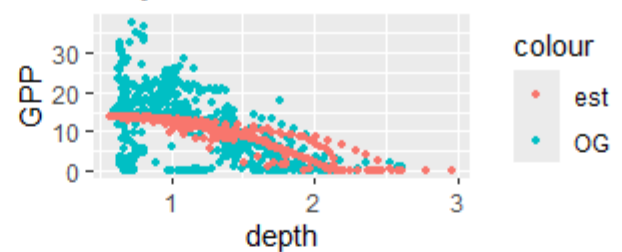
Linear Model



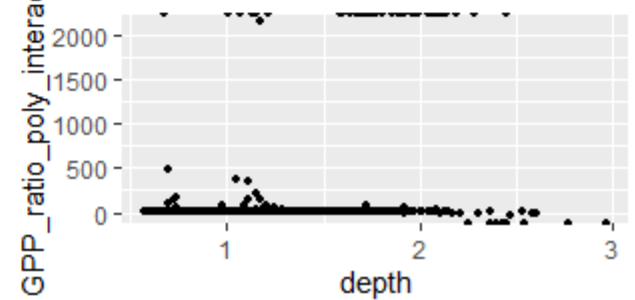
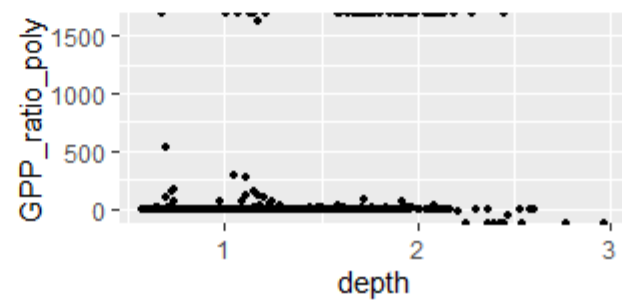
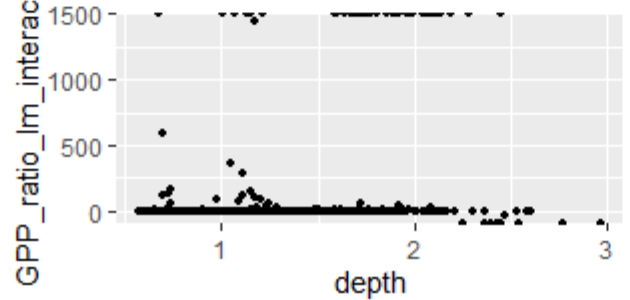
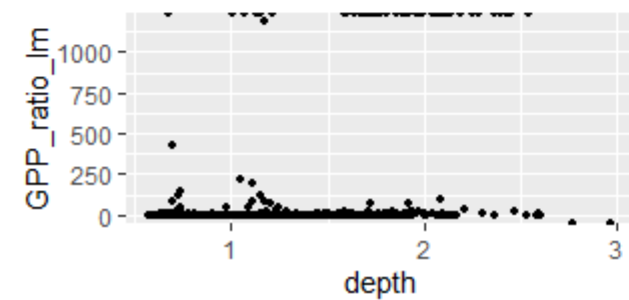
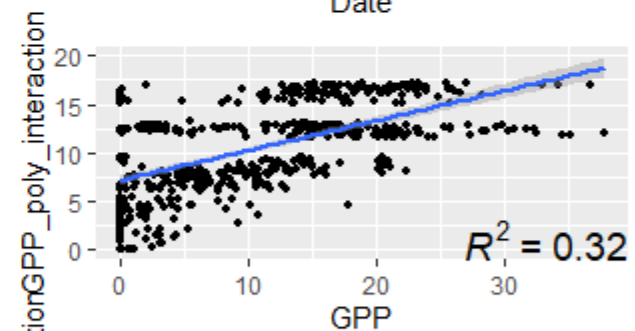
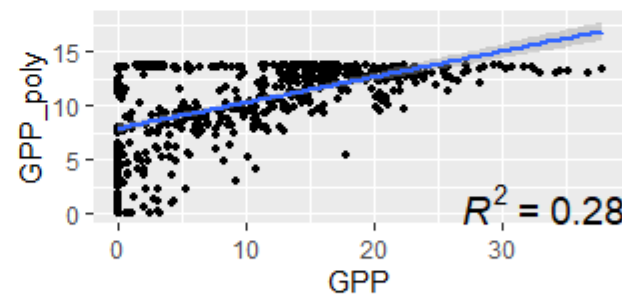
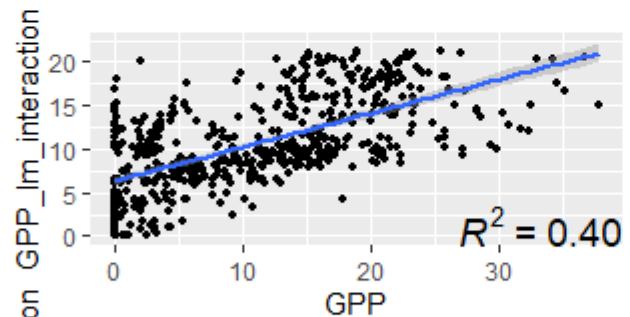
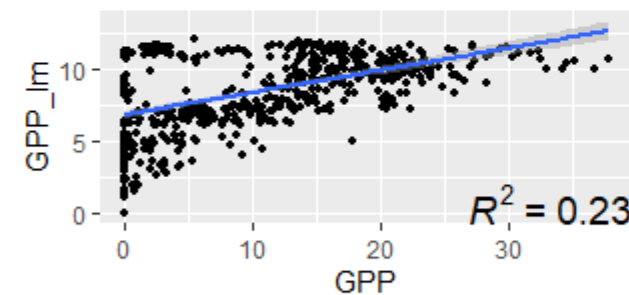
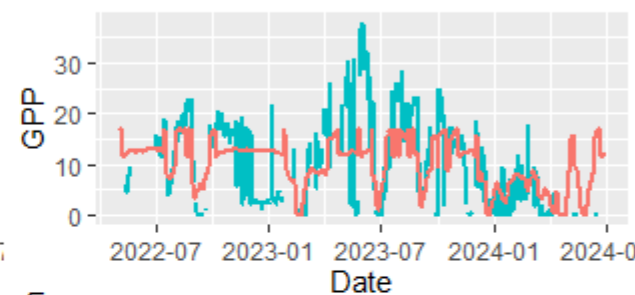
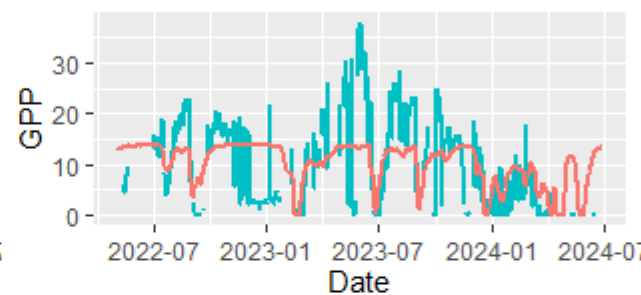
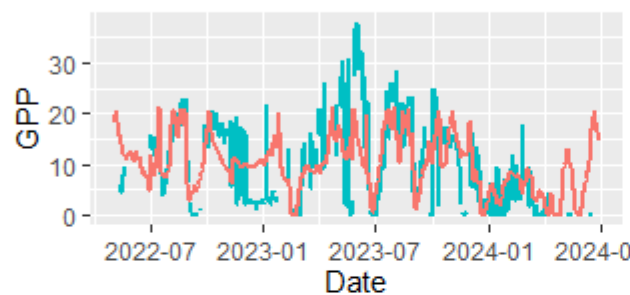
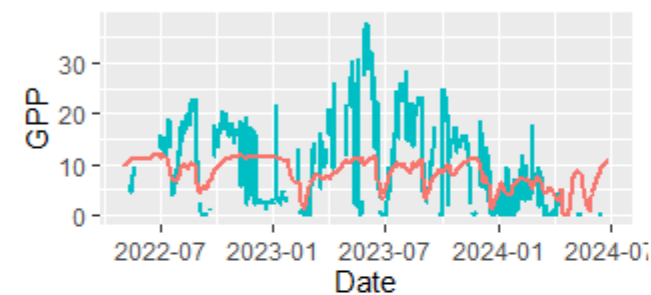
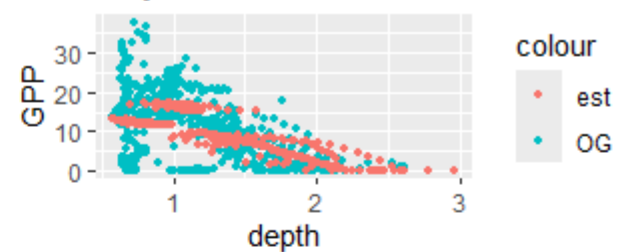
Lineaer Model with interaction



Polynomial Model



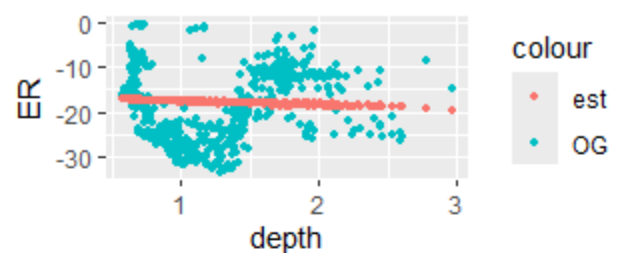
Polynomial Model with Interaction



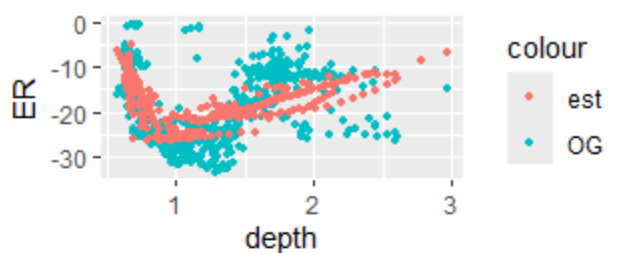


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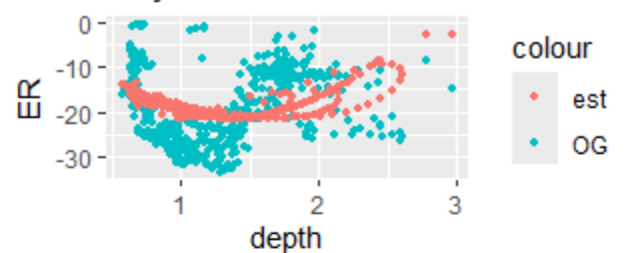
Linear Model



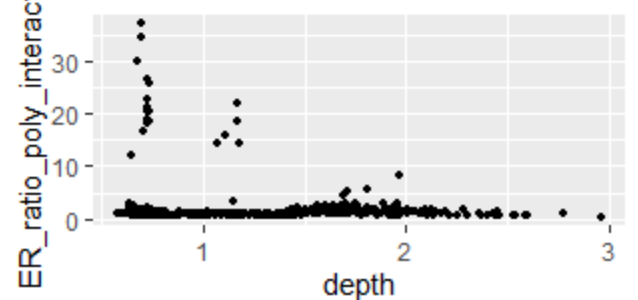
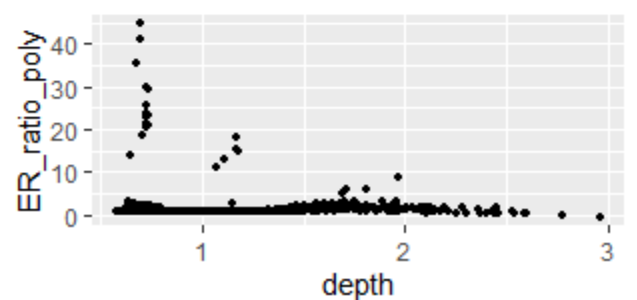
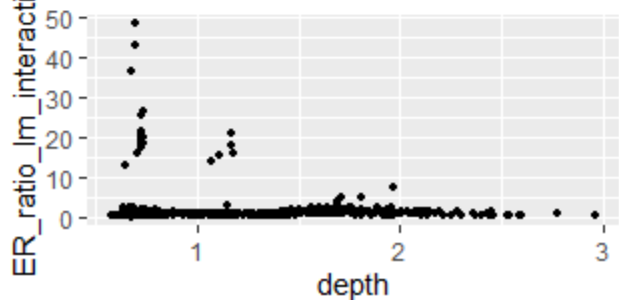
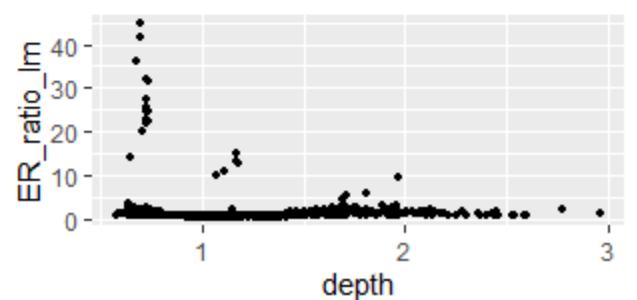
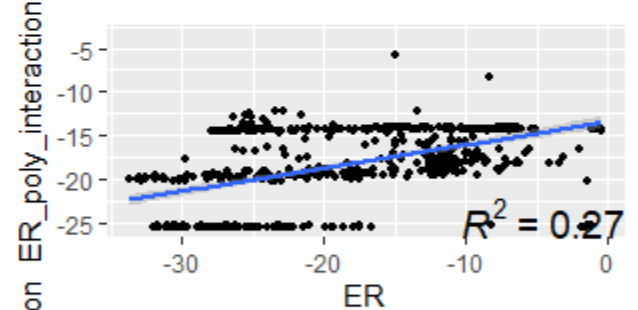
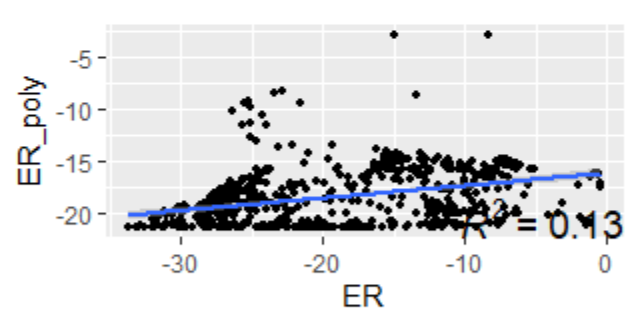
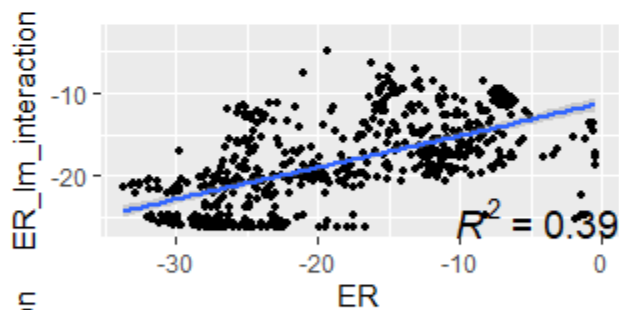
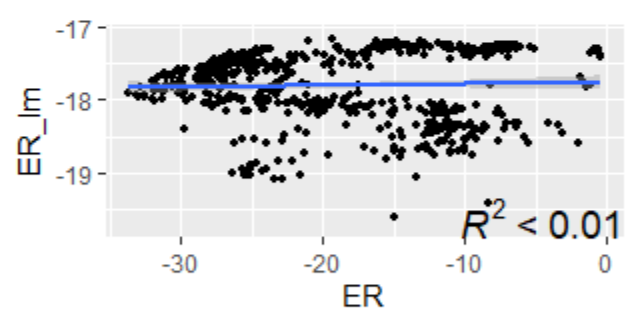
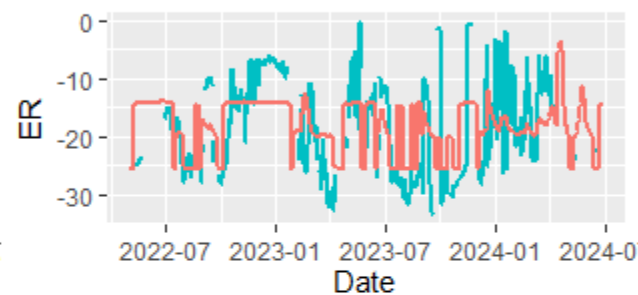
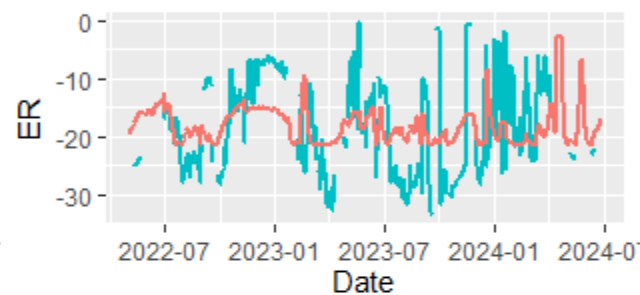
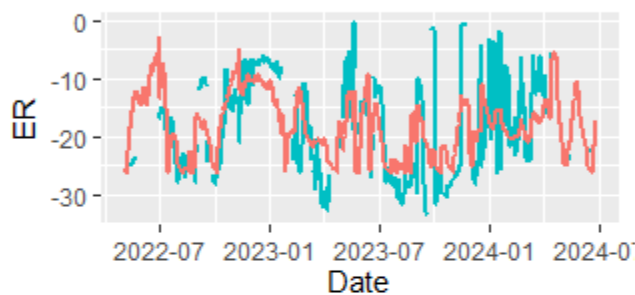
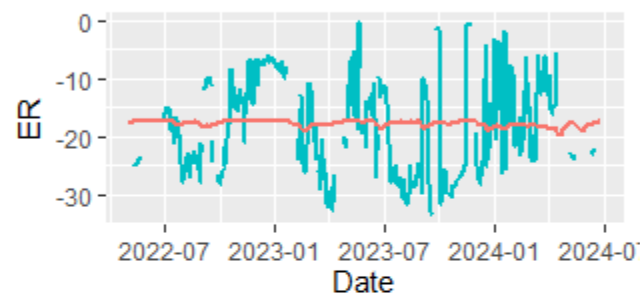
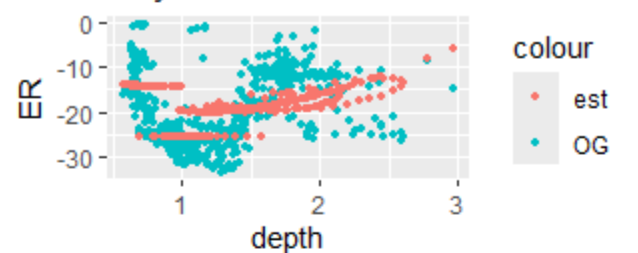
Lineaer Model with interaction



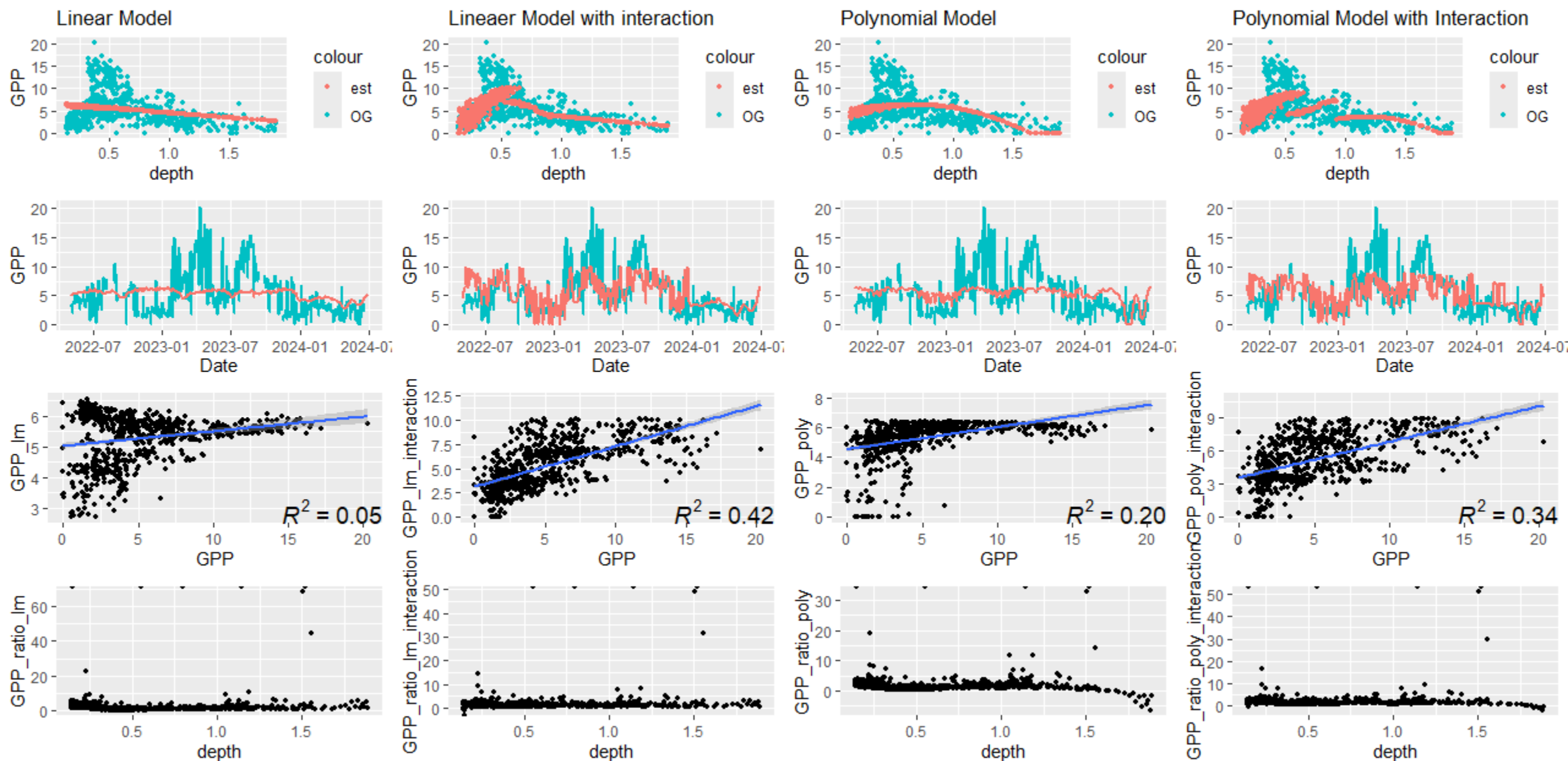
Polynomial Model



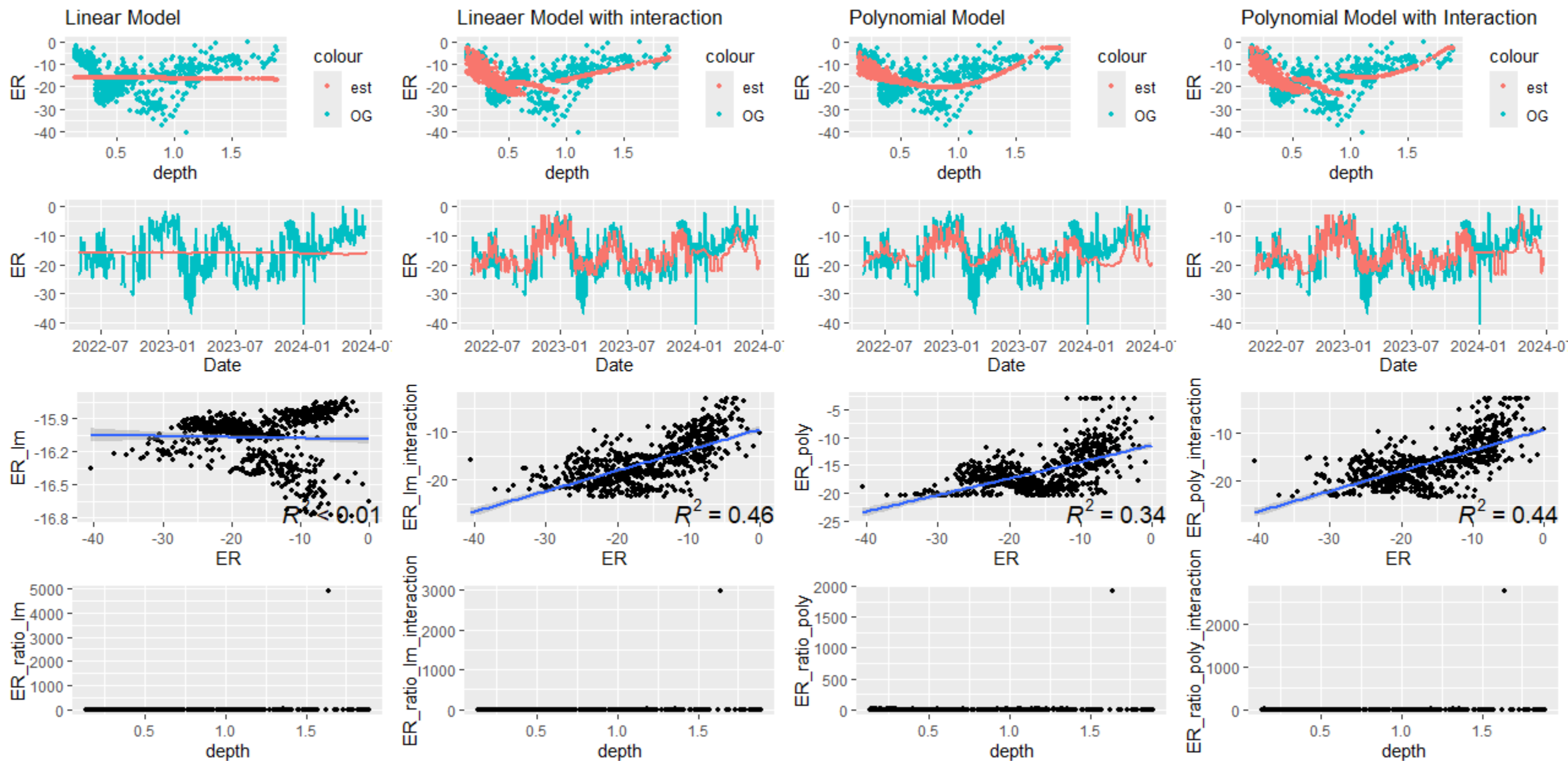
Polynomial Model with Interaction



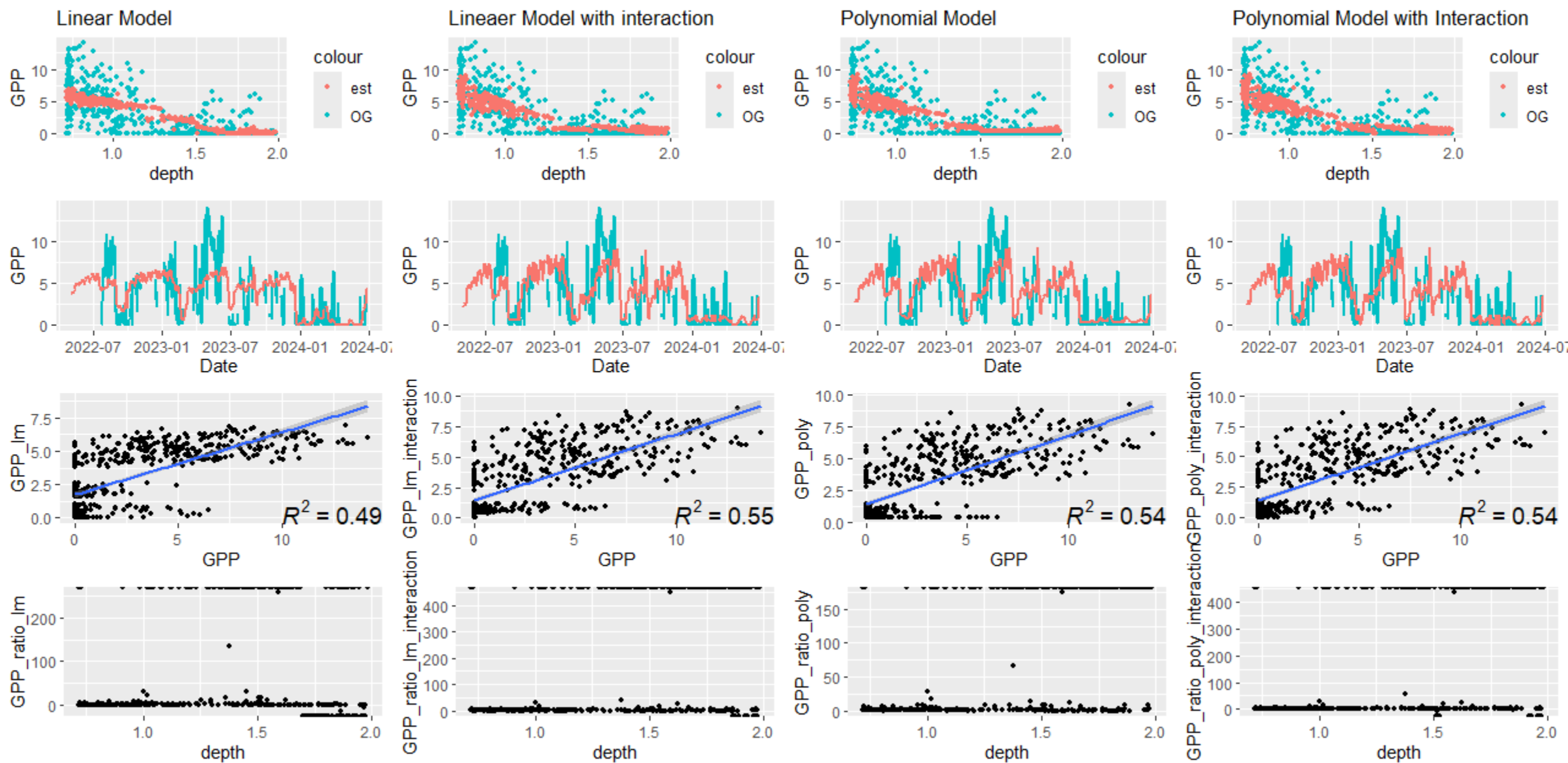
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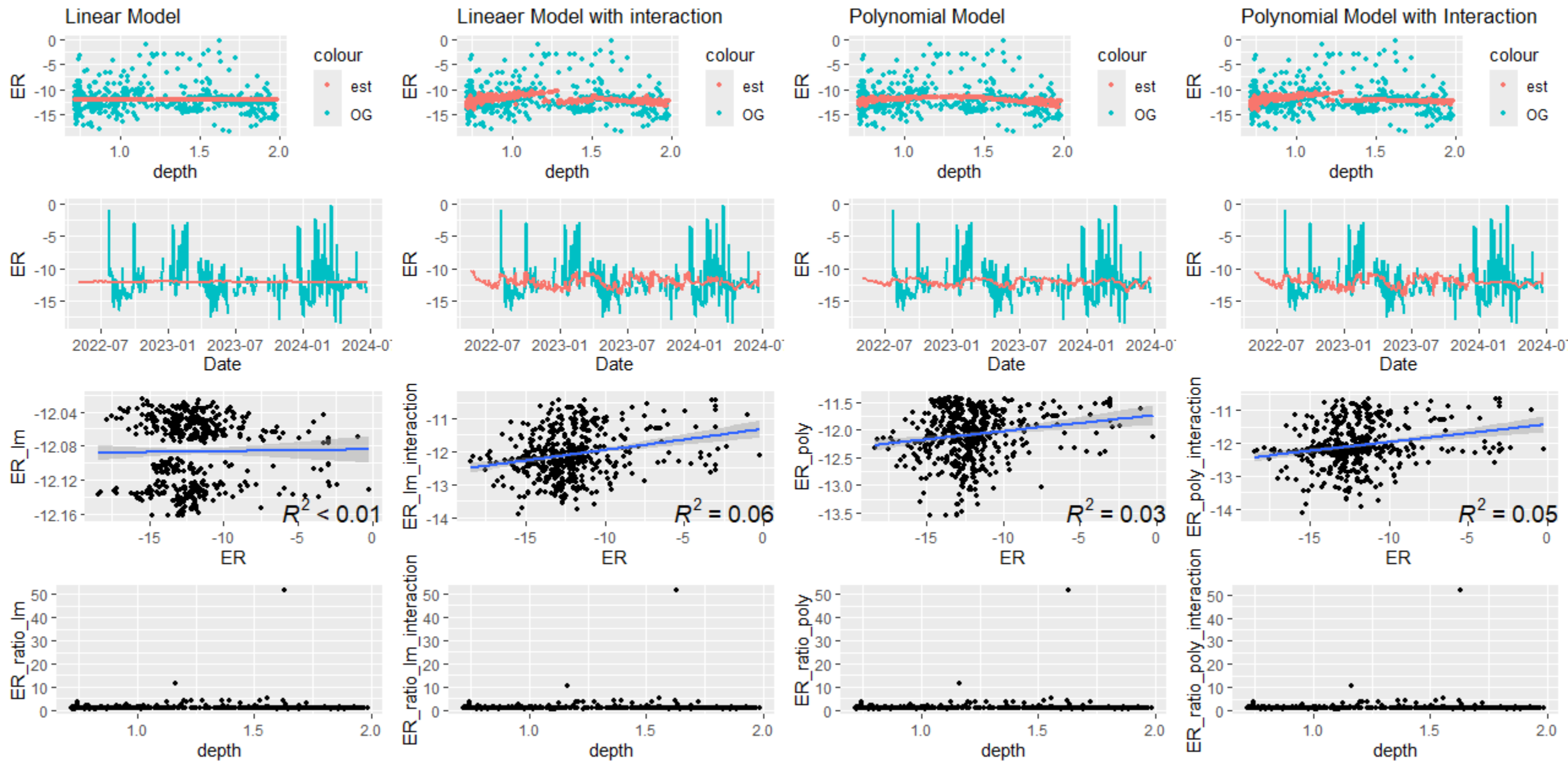
# LF



# OS

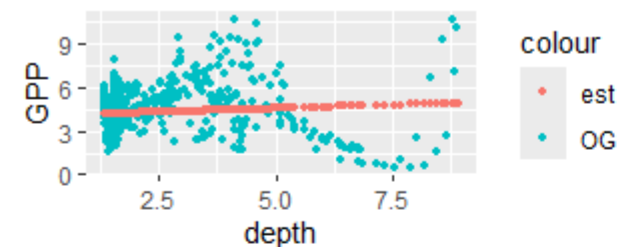


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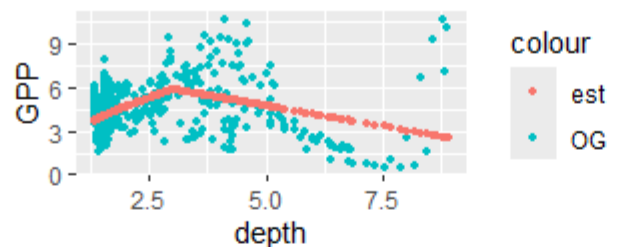




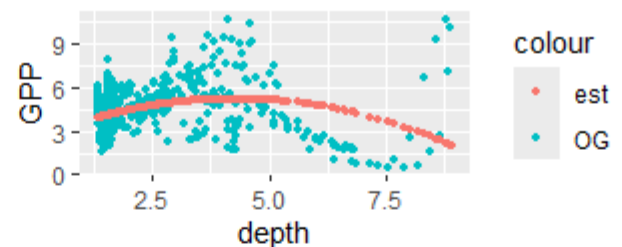
Linear Model



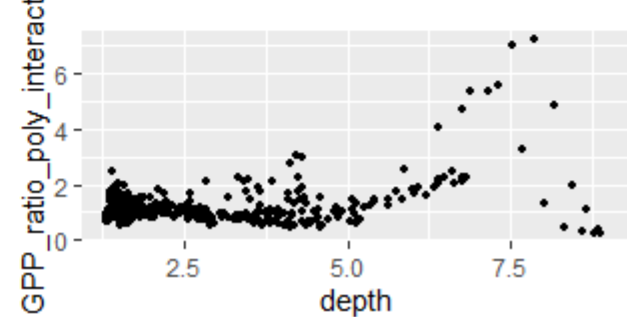
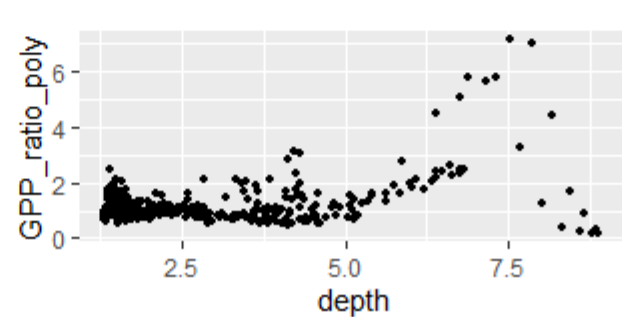
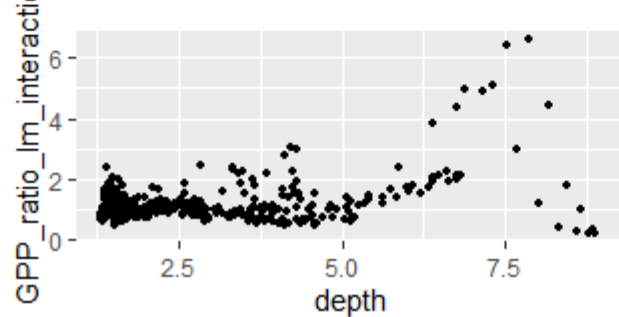
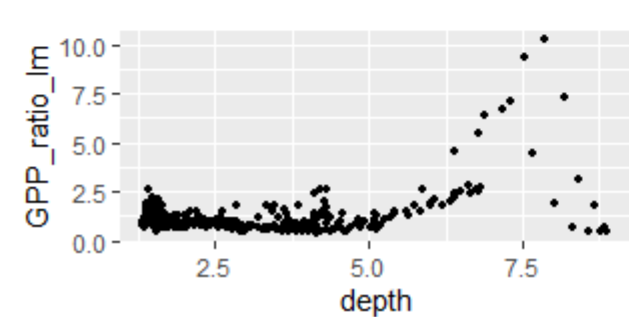
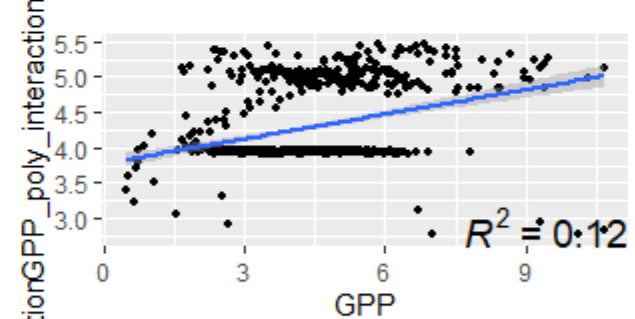
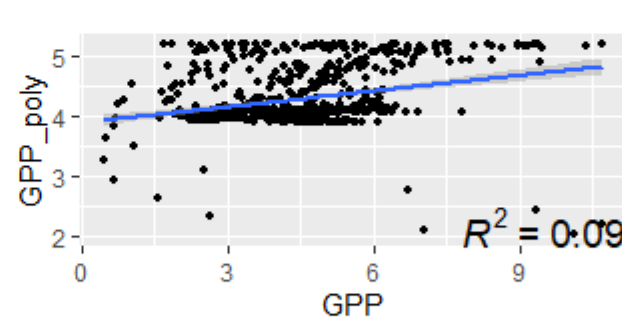
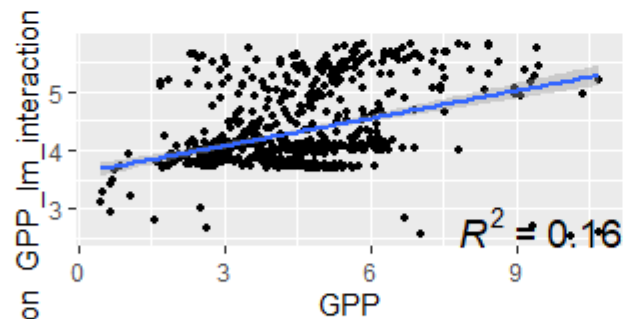
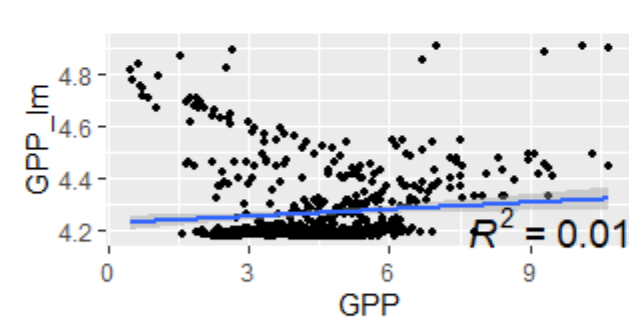
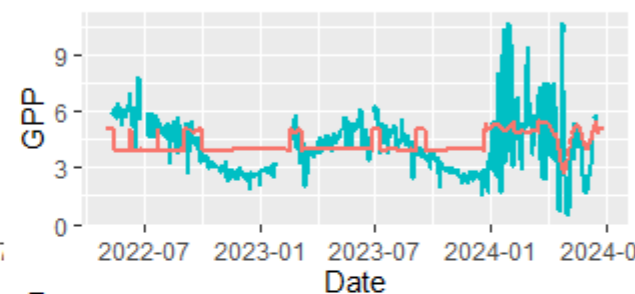
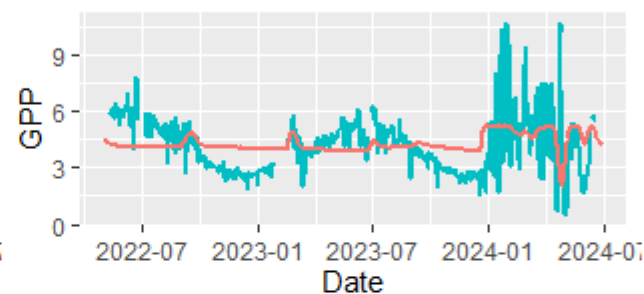
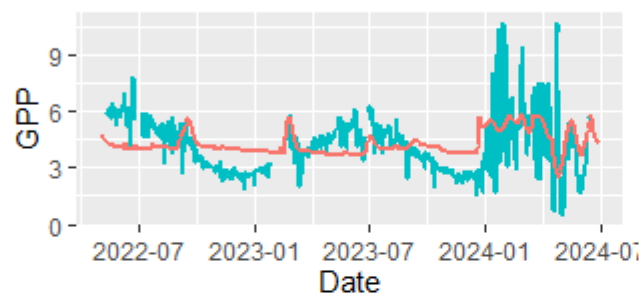
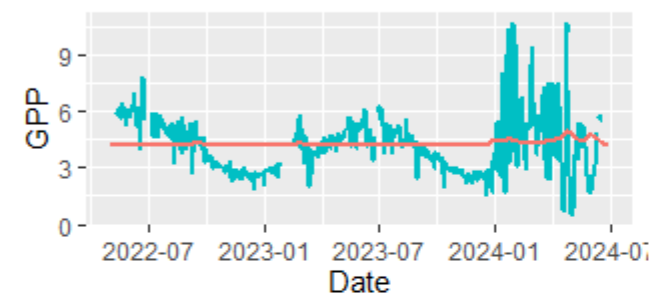
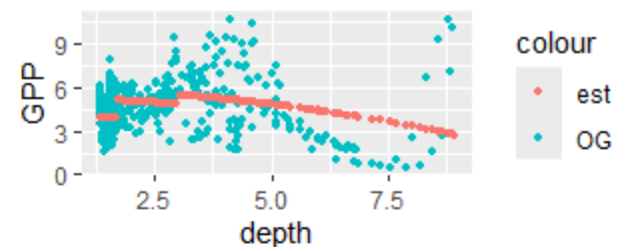
Lineaer Model with interaction



Polynomial Model

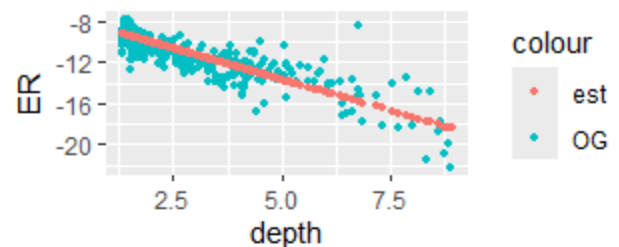


Polynomial Model with Interaction

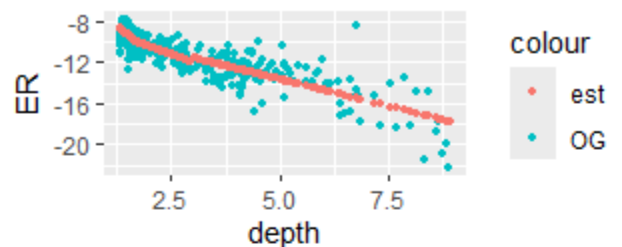


IU

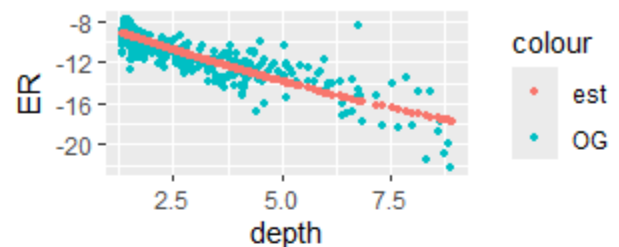
Linear Model



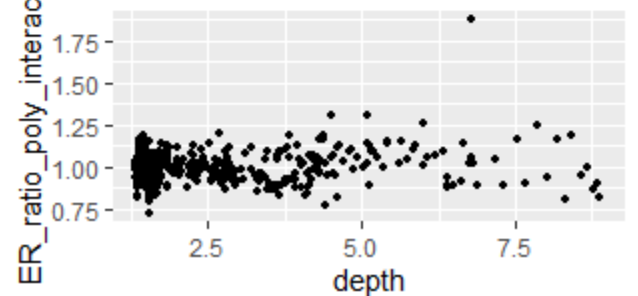
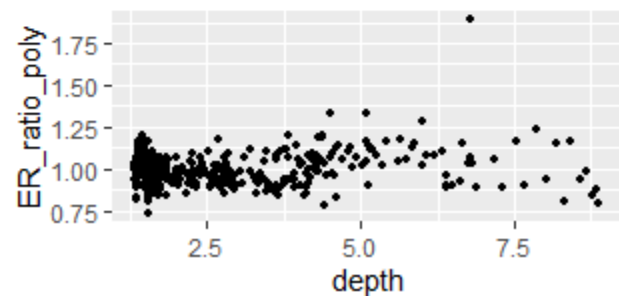
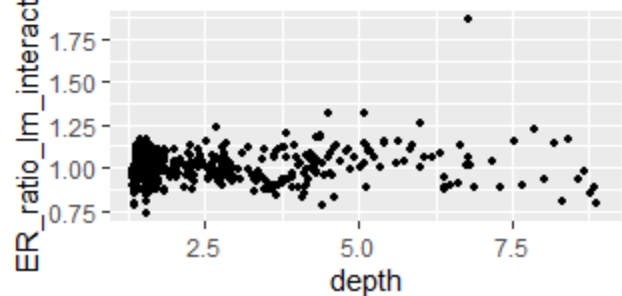
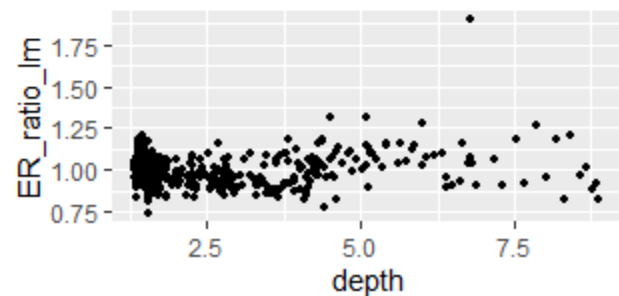
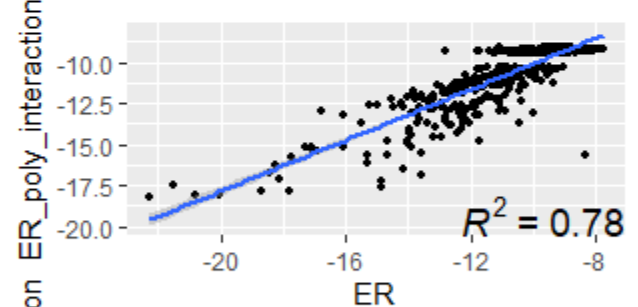
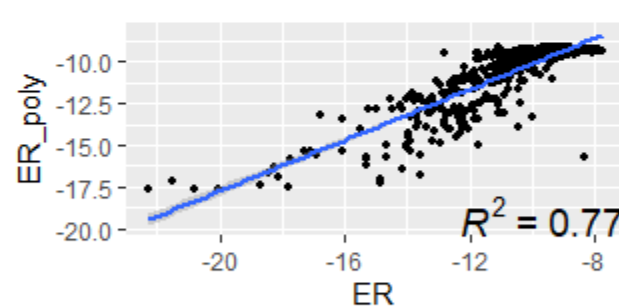
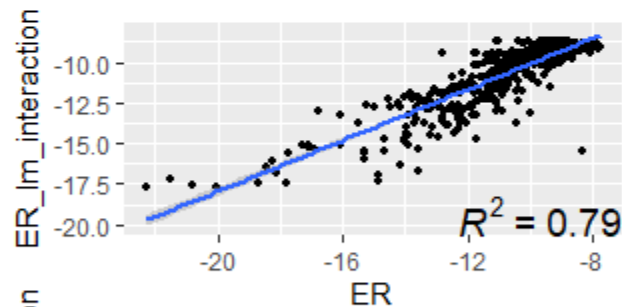
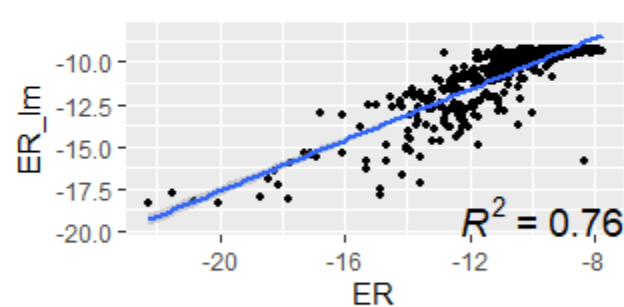
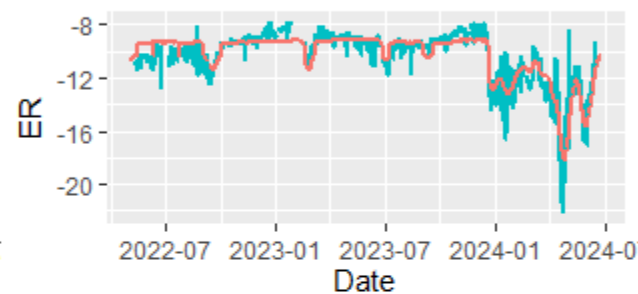
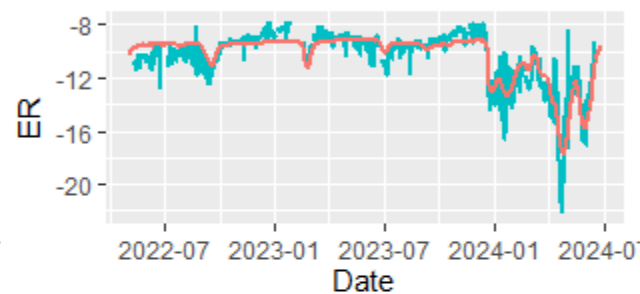
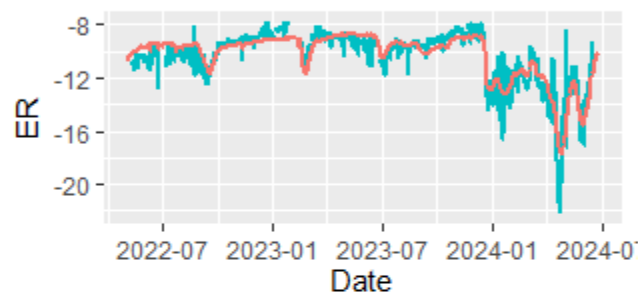
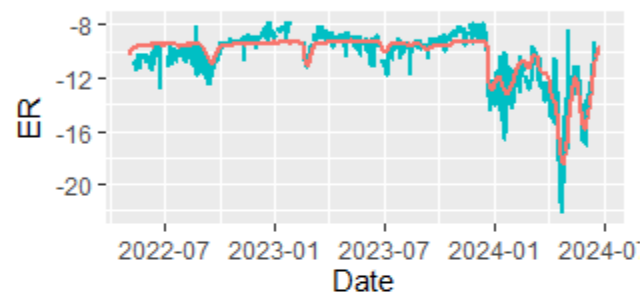
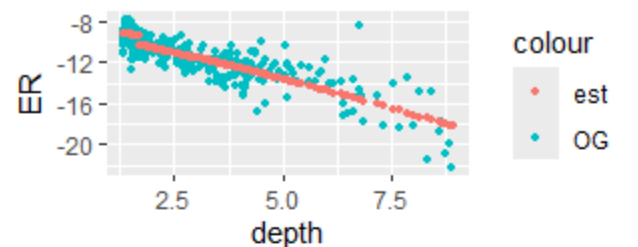
Lineaer Model with interaction



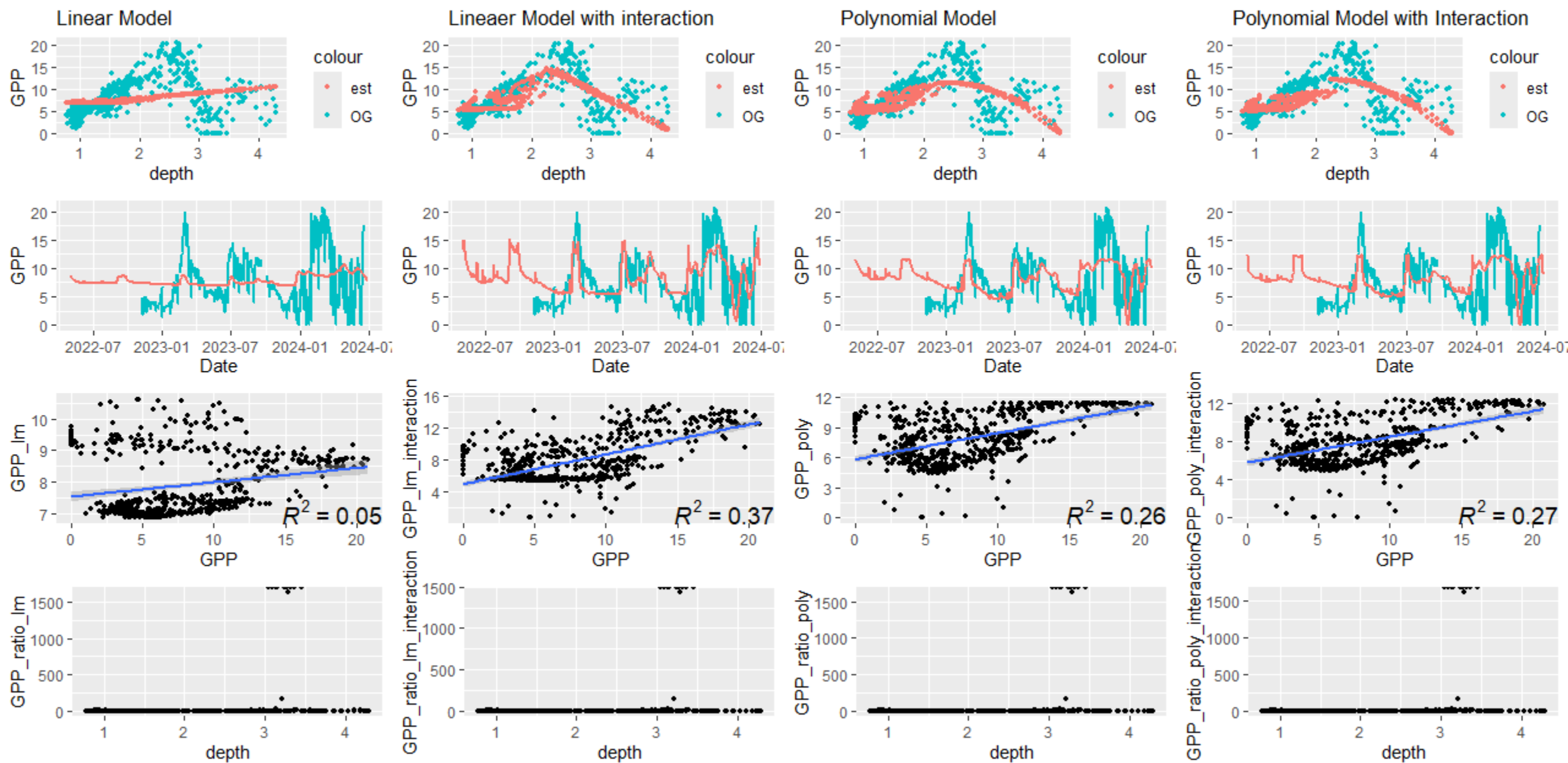
Polynomial Model



Polynomial Model with Interaction

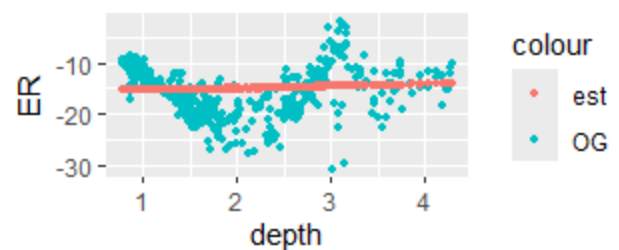


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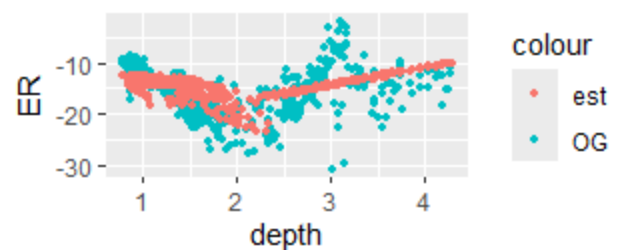


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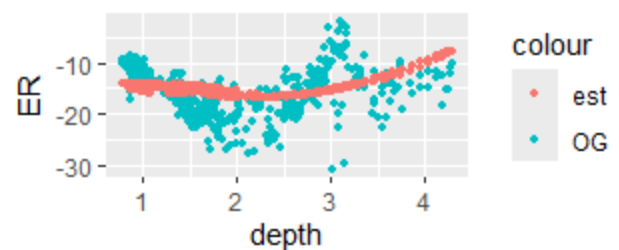
Linear Model



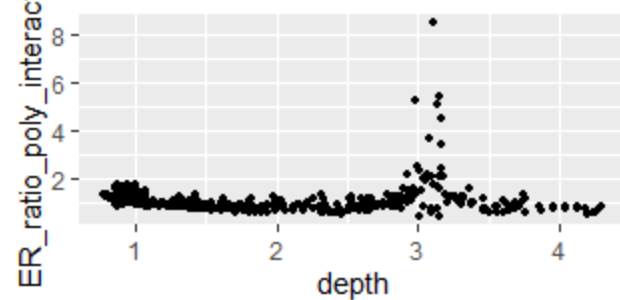
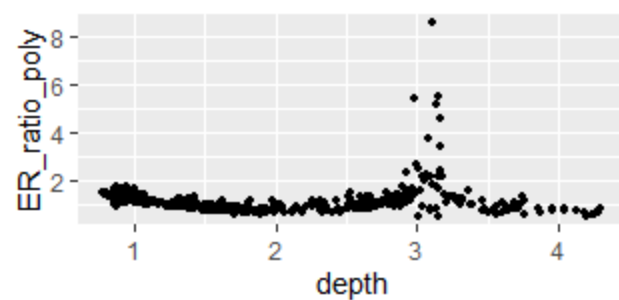
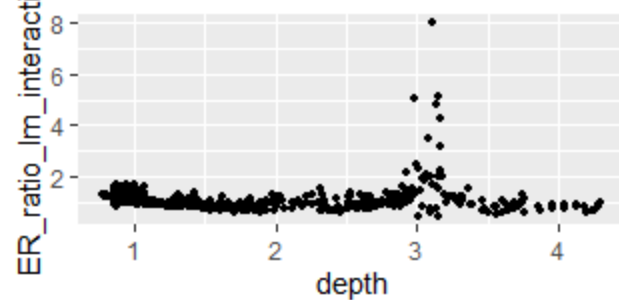
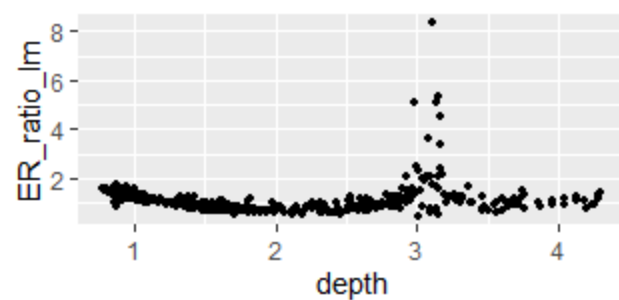
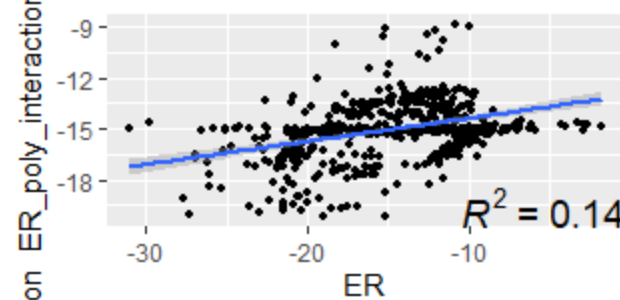
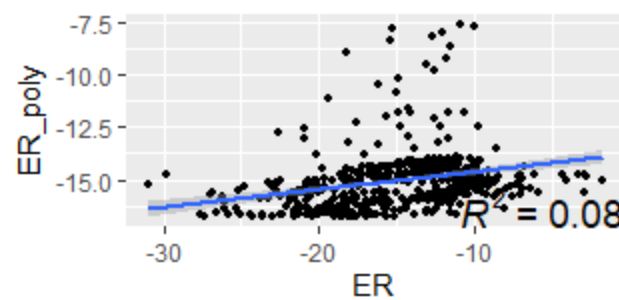
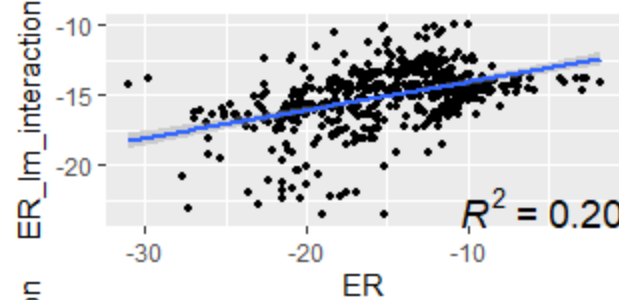
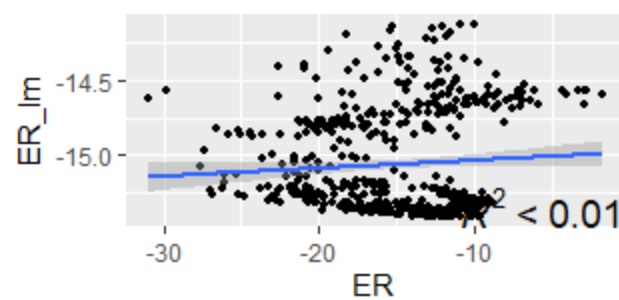
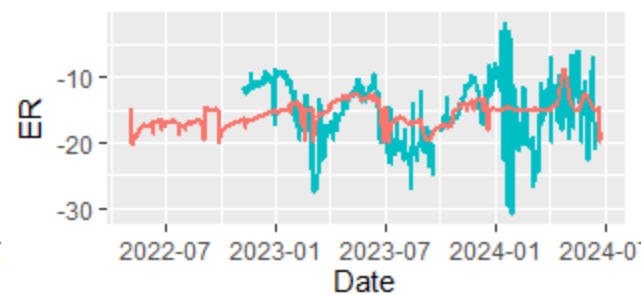
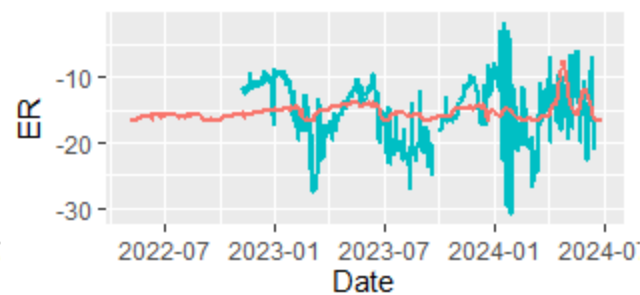
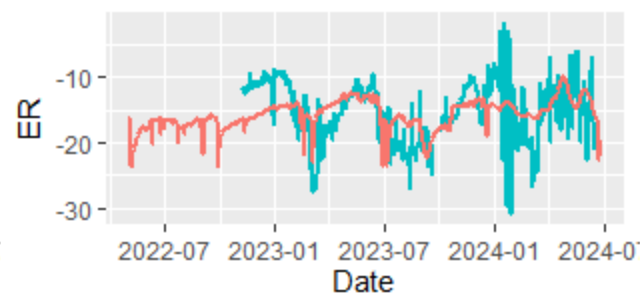
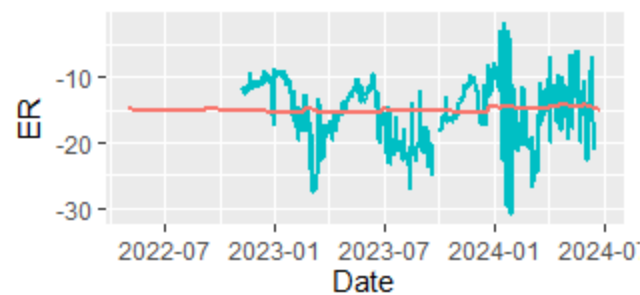
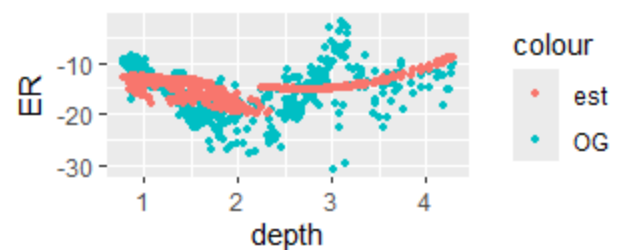
Lineaer Model with interaction



Polynomial Model



Polynomial Model with Interaction



# Thoughts




- Lm is terrible. I think lm + interpolation is the best.
- ... and its best at low to moderate-ish stage. It is terrible during high stage/disturbance.
- Different drivers at differing time scales? Stage may be important to spring metabolism during normal conditions but derails beyond a certain depth.
- I can continue to investigate interpolating historical stage at normal conditions.



# Next steps

- Continue working on interpolating metabolism
- Crack the enigma that is stream light
- Do this:

**Models of underlying autotrophic biomass dynamics fit to daily river ecosystem productivity estimates improve understanding of ecosystem disturbance and resilience**

Joanna R. Blaszczak<sup>1,2</sup>  | Charles B. Yackulic<sup>3</sup>  | Robert K. Shriver<sup>1</sup>  |  
Robert O. Hall Jr.<sup>2</sup> 