fPAR Modelling

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Modelling fPAR in respect to CSC metrics (i.e. rugosity and porosity)

I have subset the data into direct and diffuse light regimes. The a priori assumption here is based on Beer's Law.

Direct Light - fPAR as a function of Rugosity

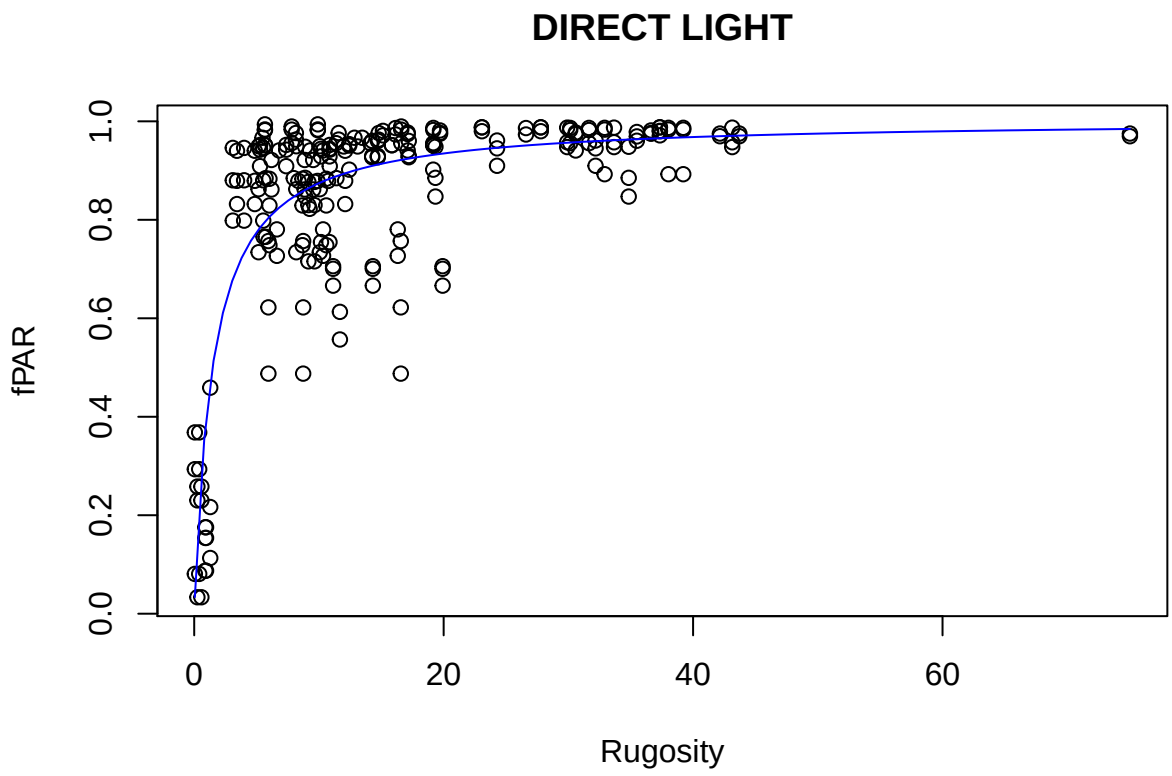
First, approximating fPAR under direct light using the best model fit:

$fPAR = (a * R_c)/(b + R_c)$

```
##
## Formula: y ~ (a * x)/(b + x)
##
## Parameters:
##   Estimate Std. Error t value Pr(>|t|)
## a  1.00389    0.01485  67.619   <2e-16 ***
## b  1.48033    0.15962   9.274   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1196 on 246 degrees of freedom
##
## Number of iterations to convergence: 4
## Achieved convergence tolerance: 2.548e-06
```

```
## R squared =
```

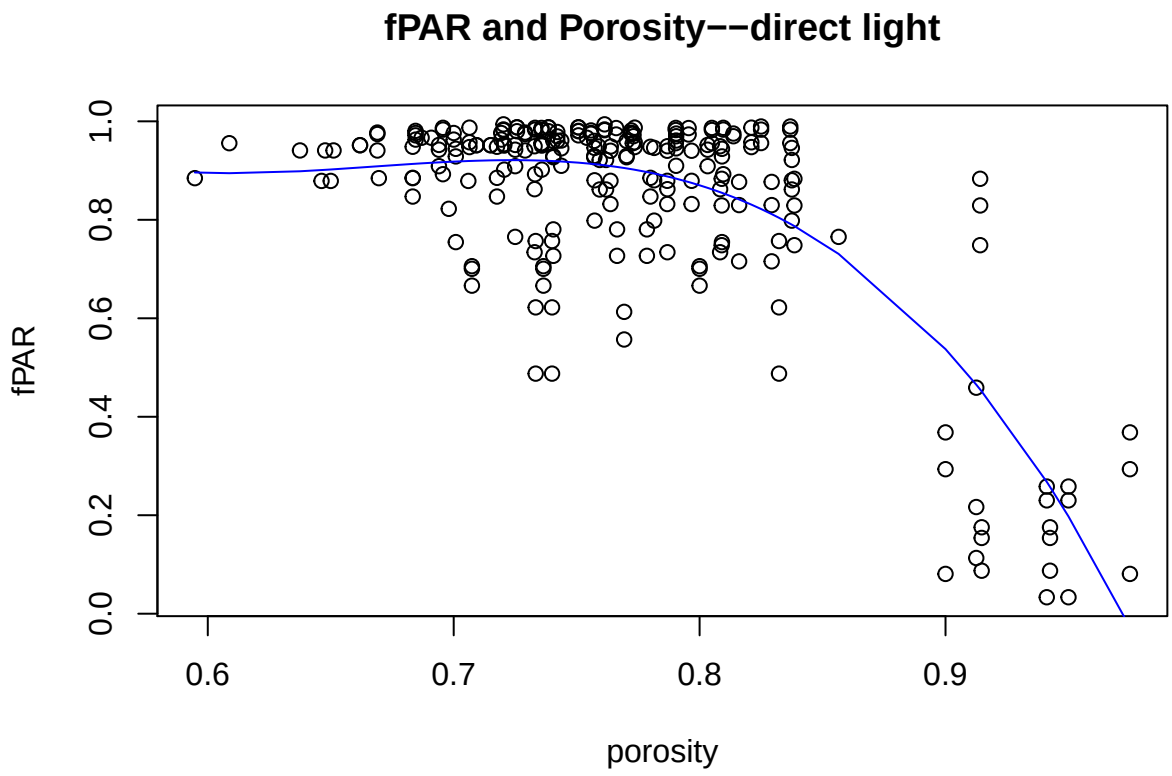
```
## [1] 0.7112929
```



Direct Light - fPAR as a function of Porosity

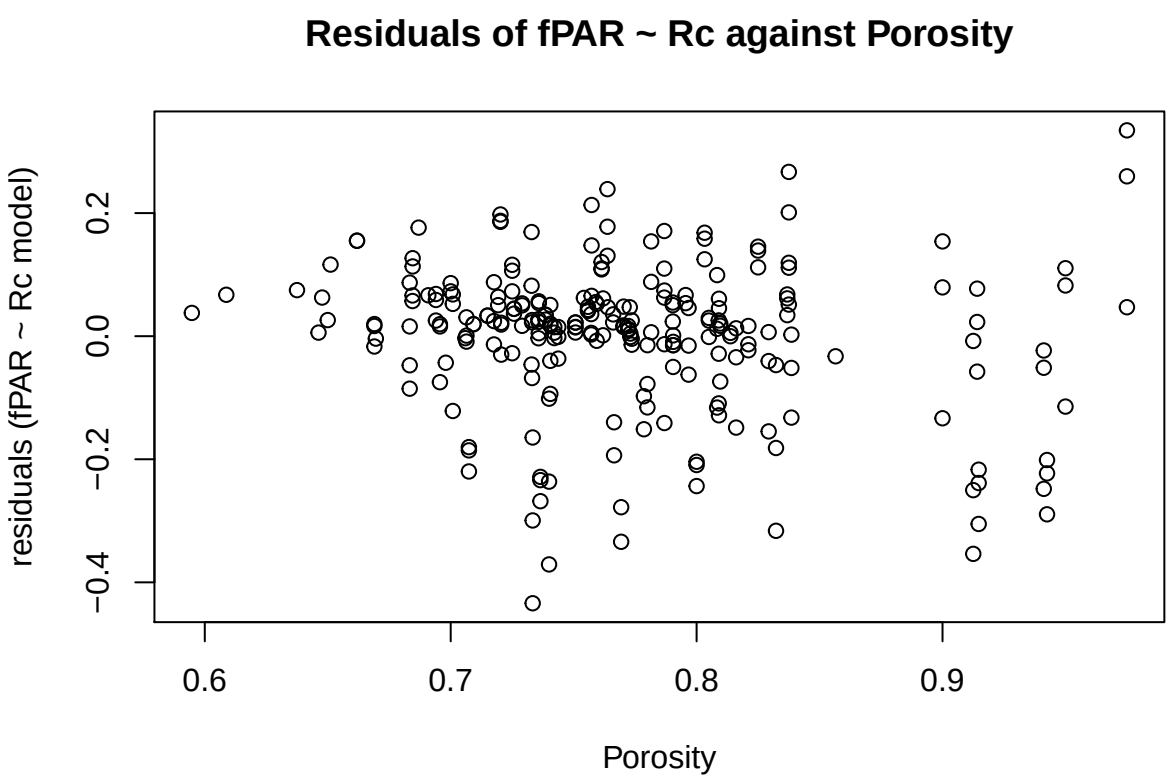
Some model exploration seems to point towards a third-order polynomial being a first-order approximation for model fit. (Can refine later):

```
##
## Call:
## lm(formula = y ~ poly(x, 3))
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.45657 -0.03788  0.03473  0.06641  0.42787
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.837514   0.008293 100.987  < 2e-16 ***
## poly(x, 3)1 -2.323364   0.130602 -17.790  < 2e-16 ***
## poly(x, 3)2 -1.574276   0.130602 -12.054  < 2e-16 ***
## poly(x, 3)3 -0.390630   0.130602  -2.991  0.00307 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1306 on 244 degrees of freedom
## Multiple R-squared:  0.6586, Adjusted R-squared:  0.6544
## F-statistic: 156.9 on 3 and 244 DF,  p-value: < 2.2e-16
```

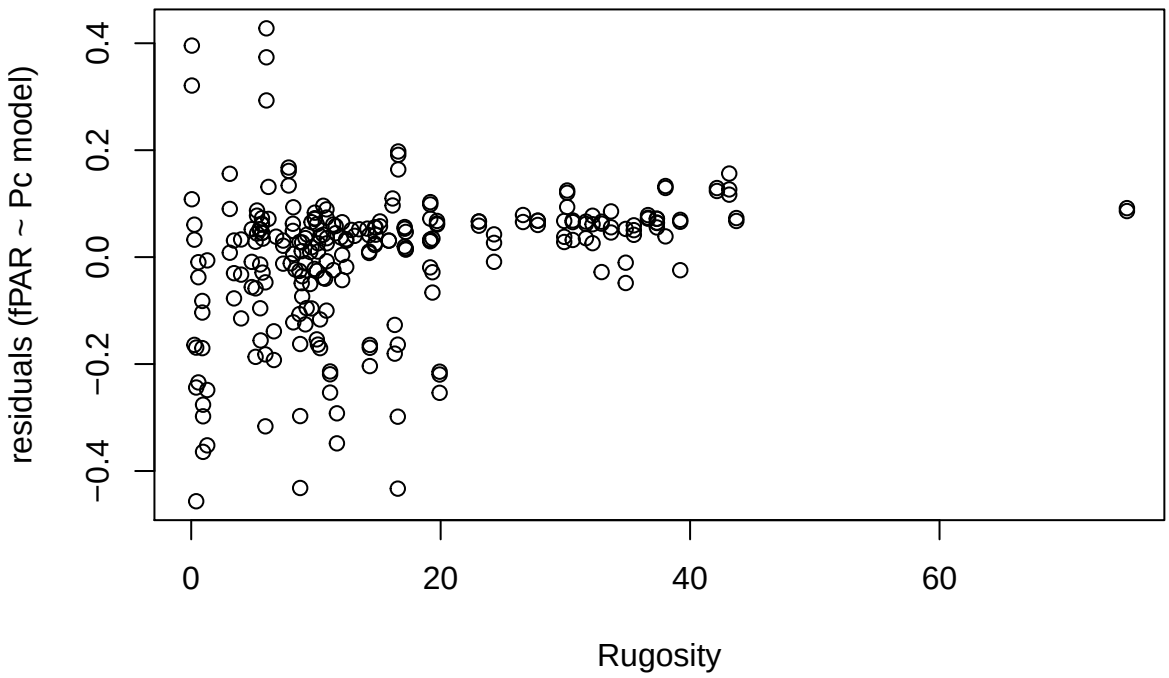


Residuals analysis one

If we extract the residuals from our fPAR $\sim R_c$ model against canopy porosity, it is mostly noise:



Now extracting residuals from our fPAR ~ Porosity model against canopy rugosity:


Residuals of fPAR ~ Pc against Rugosity
residuals (fPAR ~ Pc model)
−0.4
−0.2
0.0
0.2
0.4
0
20
40
60
Rugosity