

Model Comparison using AIC

1. Logistic regression for Meron data; phi = 1

a. fit logistic regression with only the slope and aspect variables.

	Estimate	Std. Error	z value	Pr(> z)	
(Intercept)	-1.51545	1.33905	-1.132	0.257746	
slope	9.29186	8.73780	1.063	0.287596	
ns.aspect	0.05399	0.01260	4.286	1.82e-05	***
ew.aspect	-0.06910	0.02548	-2.712	0.006697	**
slope:ns.aspect	-0.38018	0.08109	-4.688	2.75e-06	***
slope:ew.aspect	0.58702	0.17092	3.435	0.000594	***

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 256.41 on 199 degrees of freedom

Residual deviance: 205.50 on 194 degrees of freedom

AIC: 217.5

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logit.1$dev          205.5017
logLik(logit.1) -102.7509 (df=6)
logit.1$aic          217.5017
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Remark: $AIC = 217.5 = deviance + 2*6 = -2*loglik + 2*6$

b. now fit model only using anthropogenic variables

	Estimate	Std. Error	z value	Pr(> z)	
(Intercept)	1.280e+01	1.612e+03	0.008	0.993666	
road.dist	-5.846e-03	1.514e-03	-3.862	0.000113	***
water.dist	4.328e-03	1.624e-03	2.666	0.007685	**
cattle.low	-1.309e+01	1.612e+03	-0.008	0.993519	
cattle.medium	-1.380e+01	1.612e+03	-0.009	0.993170	
cattle.high	-1.774e+01	1.612e+03	-0.011	0.991220	
goats.low	5.819e+00	2.444e+03	0.002	0.998100	
goats.medium	-1.320e+01	1.612e+03	-0.008	0.993467	

AIC: 165.15

c. now fit model with all variables except for the anthropogenic ones.

	Estimate	Std. Error	z value	Pr(> z)	
(Intercept)	-33.638088	6.327622	-5.316	1.06e-07	***
alt	0.039552	0.007479	5.289	1.23e-07	***
stream.dist	-0.008475	0.004535	-1.869	0.061664	.
slope	12.471255	9.648768	1.293	0.196176	
ns.aspect	0.048126	0.014217	3.385	0.000711	***
ew.aspect	-0.028055	0.029239	-0.959	0.337309	
slope:ns.aspect	-0.353635	0.089614	-3.946	7.94e-05	***
slope:ew.aspect	0.428155	0.188328	2.273	0.022999	*

AIC: 182.29

d. now fit model with all the variables

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.542e+01	1.546e+01	-1.645	0.10007
alt	3.123e-02	1.767e-02	1.767	0.07720 .
stream.dist	-9.731e-03	6.927e-03	-1.405	0.16006
road.dist	-2.161e-03	2.342e-03	-0.922	0.35636
water.dist	2.636e-03	2.121e-03	1.243	0.21388
slope	1.209e+01	1.183e+01	1.023	0.30644
ns.aspect	3.056e-02	1.835e-02	1.665	0.09588 .
ew.aspect	-2.452e-02	3.709e-02	-0.661	0.50851
cattle.medium	-2.056e+00	1.252e+00	-1.642	0.10066
cattle.high	-3.221e+00	1.708e+00	-1.886	0.05929 .
goats.low	1.544e+01	1.185e+03	0.013	0.98961
goats.medium	-2.732e+00	2.337e+00	-1.169	0.24250
slope:ns.aspect	-3.193e-01	1.112e-01	-2.872	0.00408 **
slope:ew.aspect	3.088e-01	2.411e-01	1.281	0.20026

AIC: 144.09

**e. conclusion: AIC(all) << AIC(anthropogenic)
<< AIC(all except anthropogenic) << AIC(slope and aspect)**

2. now for mismatch data, where phi is estimated

a. first fit full model, Gamma with inverse link

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	6.209e-03	6.824e-03	0.910	0.369
reject	-8.670e-03	5.153e-03	-1.682	0.102
mismatch	3.443e-03	2.241e-03	1.536	0.134
age	1.030e-05	1.092e-04	0.094	0.925
wait_time	6.936e-06	4.831e-05	0.144	0.887
cal_time	2.206e-06	1.763e-06	1.251	0.220

(Dispersion parameter for Gamma family taken to be 1.90811)

Residual deviance: 60.603 on 33 degrees of freedom

AIC: 491.56

loglik.1 = logLik(gamma.1) = -238.7812 (df=7; includes phi)

$$-2\ell(H) + 2p = 2*(238.78) + 2*7 = 491.56$$

b. now fit a model with reject, mismatch and age

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	7.280e-03	7.440e-03	0.979	0.3345
reject	-9.481e-03	5.137e-03	-1.846	0.0734 .
mismatch	4.246e-03	2.206e-03	1.925	0.0623 .
age	2.447e-05	1.236e-04	0.198	0.8442

(Dispersion parameter for Gamma family taken to be 1.956776)

Residual deviance: 64.791 on 35 degrees of freedom

AIC: 490.77

c. now fit a model with mismatch and calendar time

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	-1.120e-05	1.802e-03	-0.006	0.995
mismatch	2.187e-03	1.538e-03	1.422	0.164
cal_time	2.722e-06	1.629e-06	1.671	0.103

(Dispersion parameter for Gamma family taken to be **1.747643**)

Residual deviance: **72.531** on 36 degrees of freedom

AIC: 494.25

d. comparison of models

0 < AIC2 - AIC1 < 2 : no real difference
4 < AIC2 - AIC1 < 7 : probably a difference
10 < AIC2 - AIC1 : definitely a difference

Model	phi.hat	AIC
1	1.91	491.56
2	1.96	490.77
3	1.75	494.25

Conclusion: 2 ~ 1 < 3 (maybe)