Computational macroevolution with BAMM and BAMMtools

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1 BAMM versus stepwise AIC

- What is stepwise AIC for diversification models?
- The fundamental problem: stepwise confounds evidence for *the number of shifts* with evidence for *shift locations*
- Limited optimization in stepwise: can't find some things because can only increment complexity stepwise
- Parameter uncertainty is not accounted for
- BAMM relaxes assumption of homogeneous diversification rates through time

2 Running BAMM

- The control file
- Invoking the program
- Setting priors with `setBAMMpriors` from `BAMMtools`

3 BAMM post-processing

- Anatomy of an MCMC output file
- Anatomy of an event data file
- Run info
- Analysis of convergence with `coda` and visual inspection

4 Basic model selection with BAMM and BAMMtools

- The posterior and the prior
- The `plotPrior` function
- Bayes factors for model comparison
- Bayes factors cannot be computed for models that are not sampled

5 BAMMtools analyses: basics

- Reading in the event data file with `getEventData`
- How many rate shifts? (see above as well)
- Visualizing rate heterogeneity (`plot.bammdata`, `subsetEventData`, `addBAMMshifts`)

6 Clade- and tip-specific rates

- `getCladeRates` and `getTipRates`
- Using the `nodetype` argument to *include* or *exlude* certain subclades.

7 Analysis of rate shifts

- Marginal shift probabilities: theory
- The `marginalShiftProbsTree` function
- The Bayesian *credible shift set*
- Distinct shift configurations
- Core versus non-core shifts
- `getBestShiftConfiguration`
- The overall *most probable* shift configuration

8 Other shift summaries

- `cumulativeShiftProbsTree`
- `maximumShiftCredibility`
- Plotting shift probabilities on individual branches or nodes using plotting techniques already covered

9 Temporal rate variation

- `plotRateThroughTime`
- The rate through time matrix
- `getRateThroughTimeMatrix`
- Advanced plot options - grayscale? 95% CIs?

10 The macroevolutionary cohort matrix

- Tool for visualizing difficult patterns
- What is a **macroevolutionary cohort?**
- Computing the cohort matrix
- Plotting the cohort matrix
- Using tip rates from `BAMM` analysis for downstream comparative studies -e.g., testing for state-dependent diversification.

11 Advanced options

11.1 Accounting for incomplete taxon sampling

11.2 Constraining the BAMM model to MEDUSA and other variants

11.3 Advanced convergence diagnostics

11.4 Trait-dependent BAMM (STRAPP)

11.5 Troubleshooting