AD Model Builder

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AD Model Builder

Powerful program to fit models
Fast, reliable, flexible

Free software
Somewhat hard to learn

Number cruncher
Use alongside Excel, R, etc.

Fitting nonlinear models

- Even simple models (<10 parameters) can have complex likelihood space

- Multiple minima, ridges and canyons

- Excel solver is easy to use, but cannot handle complex models or evaluate uncertainty

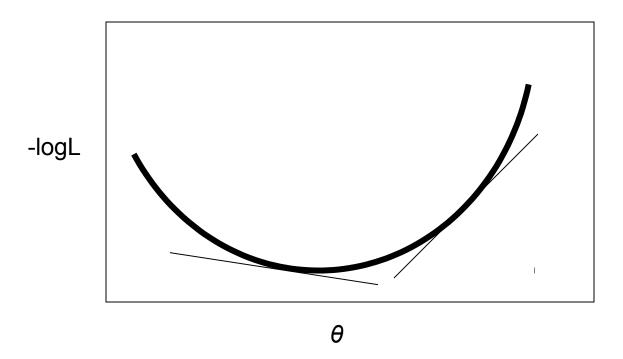- R optim() evaluates uncertainty, but cannot handle complex models

Performance

Application	Type of model	ADMB	R	BUGS
Orange tree growth	Logistic NLME	0.34	0.05	1.83
Mineralization of terbuthylazine	NLM with ODE	0.6	12	51
N-mixture models with random effects	Binomial mixture model	240	-	720
Owl nestling negotiation	Zero-inflated GLMM	4.5	15.5	725.9
Skate length-based stock assessment	State-space population model	13.0	-	174.2
Tadpole mortality as a function of size	Binomial MLE	0.031	0.066	0.194
Population growth	State-space theta-logistic	28	597	180
Weed density over time	Logistic NLM	0.096	0.008	1.018
Flowering, stage and seed production	Binomial GLMM	21	56	525

NCEAS benchmark from 2013
(model run time in sec)

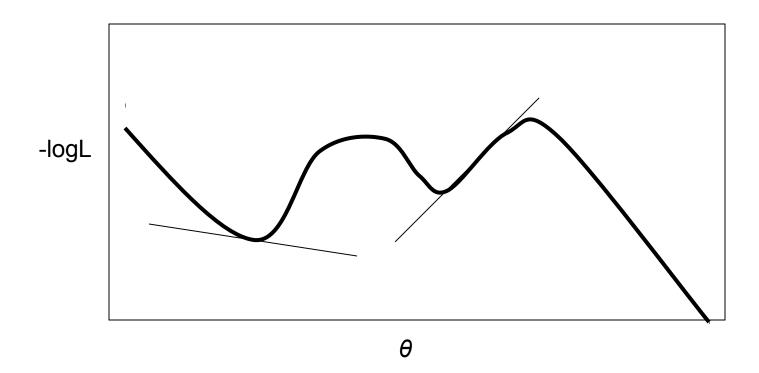ADMB several times faster than R and BUGS for non-trivial models
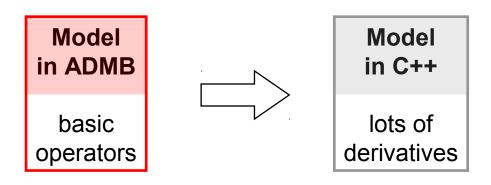
(fewer function calls)

Derivatives

Derivatives

Automatic differentiation

- The "AD" in AD Model Builder

- Models and loops can be rolled out to basic operators like + - * / ^ sqrt log exp

- All those operators are overloaded to perform differentiation (chain rule, etc.)

Model in ADMB

basic operators

$\Rightarrow$

Model in C++

lots of derivatives

History

1991 AD book (Griewank and Corliss, eds.)

1991 AUTODIF

1993 ADMB 1.0

2007 ADMB 8.0.2

2007 ADMB Foundation (Sibert, Maunder, Nielsen)

2008 ADMB 9.0 (freeware)

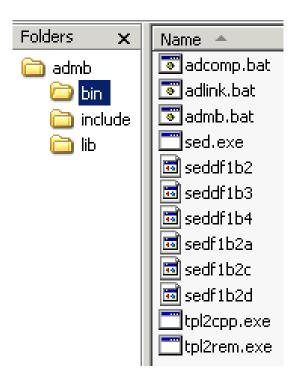2009 ADMB 9.1 (free software)
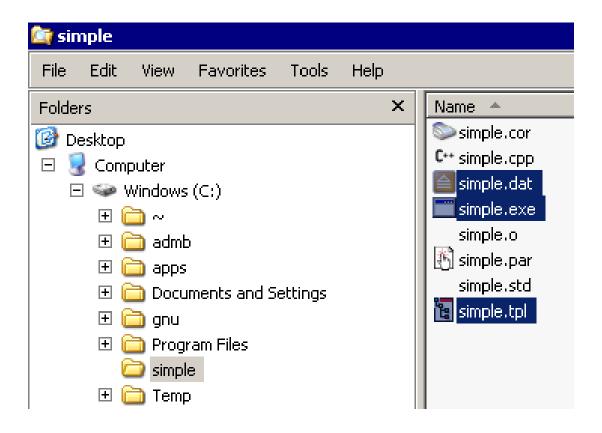
2010 ADMB Meeting (short-term and long-term goals)
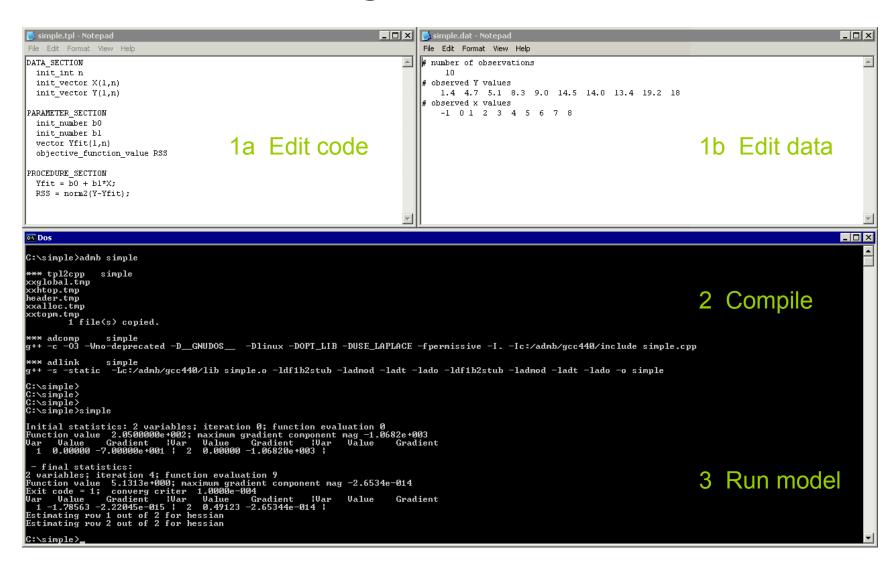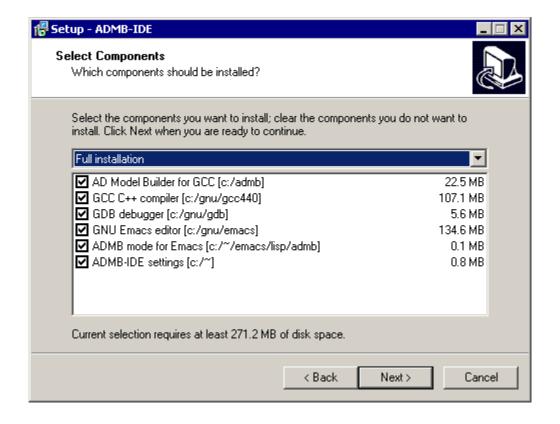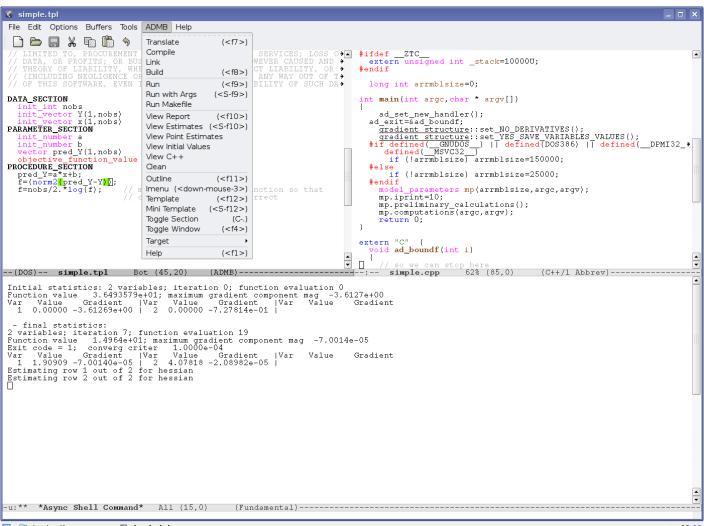
admb-project.org

ADMB directory

Model directory

Working environment
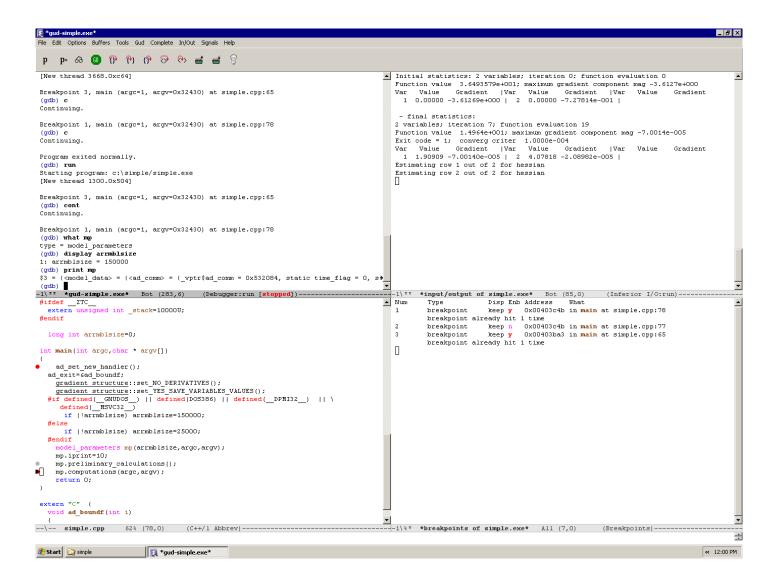
ADMB-IDE

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R packages

- CRAN: R2admb, PBSadmb, (scapeMCMC)

- R-Forge: glmmADMB

- ADMB Project: admb2r

- ADMB Newsletter: import functions

Demo

- ADMB-IDE
  - download, manuals, simple, pella

- Control file
  - initial, limits, phases, priors

- Advanced statistics
  - hessian, mcmc, random effects