ATM model structure and user interface

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Purpose of document:

R package ATM includes many different forms of documentation. This "ATM model structure and user interface" document is intended to complement these other resources by documenting and describing the model structure (all model equations and notation). However, I have not added much yet. Please see reference documentation for explanation of the user interface, and GitHub wiki for examples.

Table 1 – Explanation of parameters including symbol from Thorson et al. (2021) and see Appendices for full list, as well as the name in TMB code, and explanation for the action of that parameter

Coefficient	Code	Explanation
$\log(\beta)$	ln_sigma_l	Vector of coefficients, transformed to generate diffusion-rate parameters. In Thorson et al. (2021), ln_sigma_l was a one-length vector that was equal to constant log-diffusion rate $\log(\beta)$
α'_k	alpha_logit_ratio_k	Vector of coefficients transformed to generate covariate-response coefficients α_k that define the preference function
$\mathbf{H}$	ln_H_input	Values are transformed to generate matrix representing geometric anisotropy
$\log(\kappa)$	ln_kappa	Decorrelation rate
$\log(\sigma_0)$	ln_sigma_epsilon0	Magnitude of spatial variation in initial time (representing net effect of processes prior to model start)
$\log(\sigma_\varepsilon)$	ln_sigma_epsilon	Magnitude of spatio-temporal variation in each interval, relative to prediction from previous one.
ψ'	power_prime	Tweedie power $\psi = 1 + logit(\psi')$
$\log(\varphi)$	ln_phi	Tweedie variance scaling parameter, such that variance $\mathbb{V}(b) = \varphi\mu^\psi$
$\log(\sigma)$	ln_CV	
λ	lambda	Fishing power ratio for fishery relative to survey
$\delta(t)$	Beta_t	Changes in overall abundance between time-intervals
$\log\big(d(s,t)\big)$	ln_d_st	Log-numerical density at each location s and time t