LSSM_documentation

Edward Gregr

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Model overview

This section describes the model components

Dynamic energy budget growth model

The Dynamic energy budget (DEB) developed by XXX was calibrated for nereocystis by Barbosa.

The DEB takes a table of [light, nutrients, temperature, and dissolved inorganic carbon (DIC)] as an input, and returns a very detailed table which includes:

###Units for the inputs T = K, temperature N = molN/L, dissolved inorganic nitrogen concentration C = molC/L, dissolved inorganic carbon concentration I = molÎ^3/mˆ2/d, photon concentration (= irradiance)

###Description (and units?) for outputs Nitrogen assimilation via regular assimilation pathway: j_NA = molN/molV/h, uptake rate of N j_CI = molDIC/molV/h, uptake rate of DIC j_I = specific relaxation rate j_CA = molC/molV/h, specific carbon assimilation rate j_Ot = O2 production j_Ct = Carbon (where?)

Allocation to growth: j_EN_G = specific flux of N to growth SU (after maintenance) j_EC_G = specific flux of C to growth SU (after maintenance) j_G = gross specific growth rate

Biomass and length: W = g L_allomt = cm, physical length

Integration of results for next steps: M_V = M_V + dMVdt * dt; m_EN = m_EN + dmENdt * dt; m_EC = m_EC + dmECdt * dt;

Data

The various data sets used for this project are described here.

Oceanographic data

###Historic moorings BATI has 2023 data from 8 moorings in the region. Main ones of interest to this project are B5, which is in Blackfish Sound, and B6, which is in a sheltered location west of Gilford Island, not unlike the Village Island basin. MAPP also has 5 moorings in the area. Of interest may be M5 (in QCS) and M4 (at the entrance to Knight Inlet). NOTE: This numbering comes from Romina, unsure if its consistent with other descriptions of these data.

The BATI moorings include sensors at different depths: 0.5 m = StarOddi CTD (T/S); 1.5 and 3 m: Hobo (T and Light); Bottom: T (sensor?). These data have been processed by Romina into a workable file of surface T/S with Station ID added (ctd_surface_cond_moorings2023.csv). A second file includes T at depth from the Hobo sensors on these moorings.

Light data from Hobos are challenging because the sensors foul up and need cleaning. The data thus need to be cleaned for the deteriorating light levels (this work is pending for Romina).

The MAPP moorings include a StarOddi only, collecting T/S at surface (~ 1m). These data have not yet been processed.

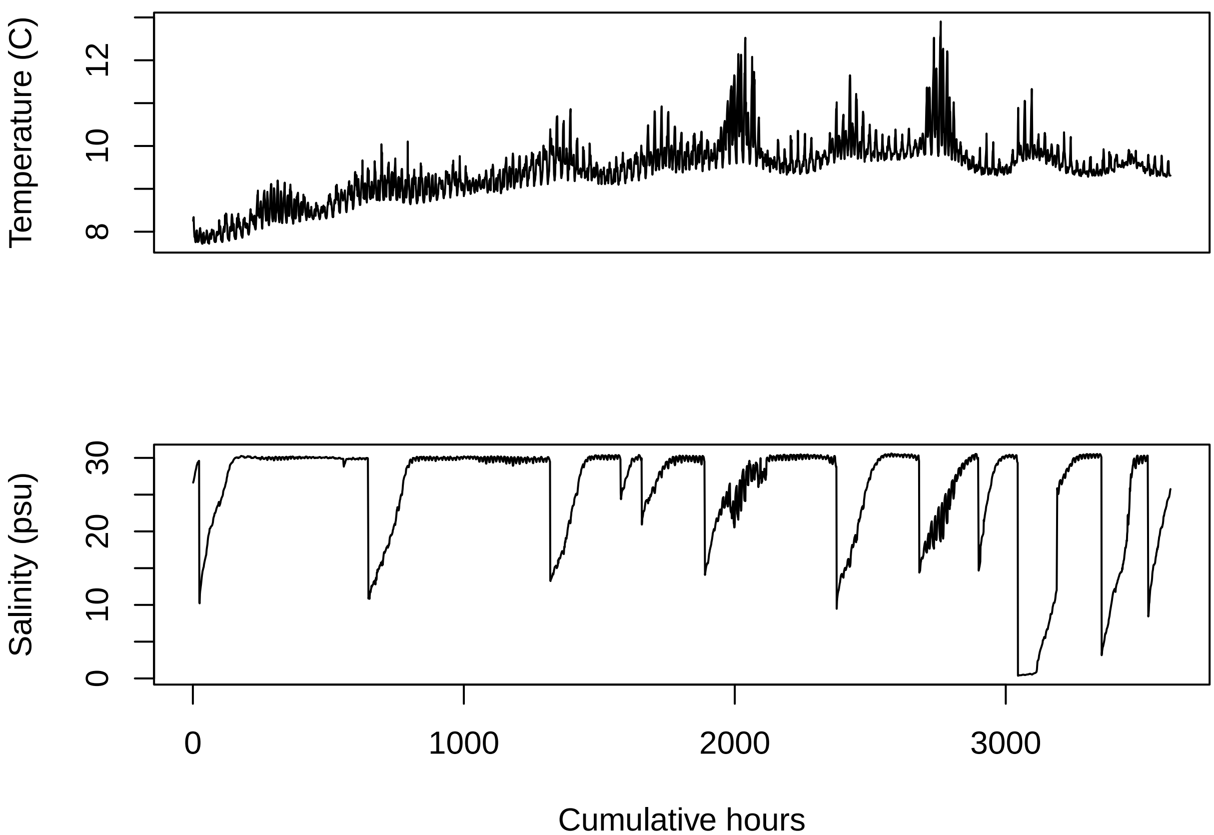

Figure 1: Temp and salt from the BATI 5 mooring

Other BATI ocean data

T/S profiles were collected during kelp sampling. Likely only relevant to water column investigations. Environmental button loggers (T only) distributed around the region and collecting data since 2022. Unclear on the number and locations, but should be useful for spatial variance in T.

Field data

Field observations of nereo helped parameterize growth and distribution

Spatial data

We built clusters to estimate the abundance and spatial distribution of nereocystis.

Methods

BUilding an environmental conditions layer

The DEB model takes a table of [light, nutrients, temperature, and DIC] as input.

Currently, this is built with constant but randomized light, nutrients and DIC. Temperature is taken from the BATI5 sensor, with the intent of comparing the pH results to BATI6, thereby comparing a QCS reference (BATI5) with and estuarine site (BATI6).

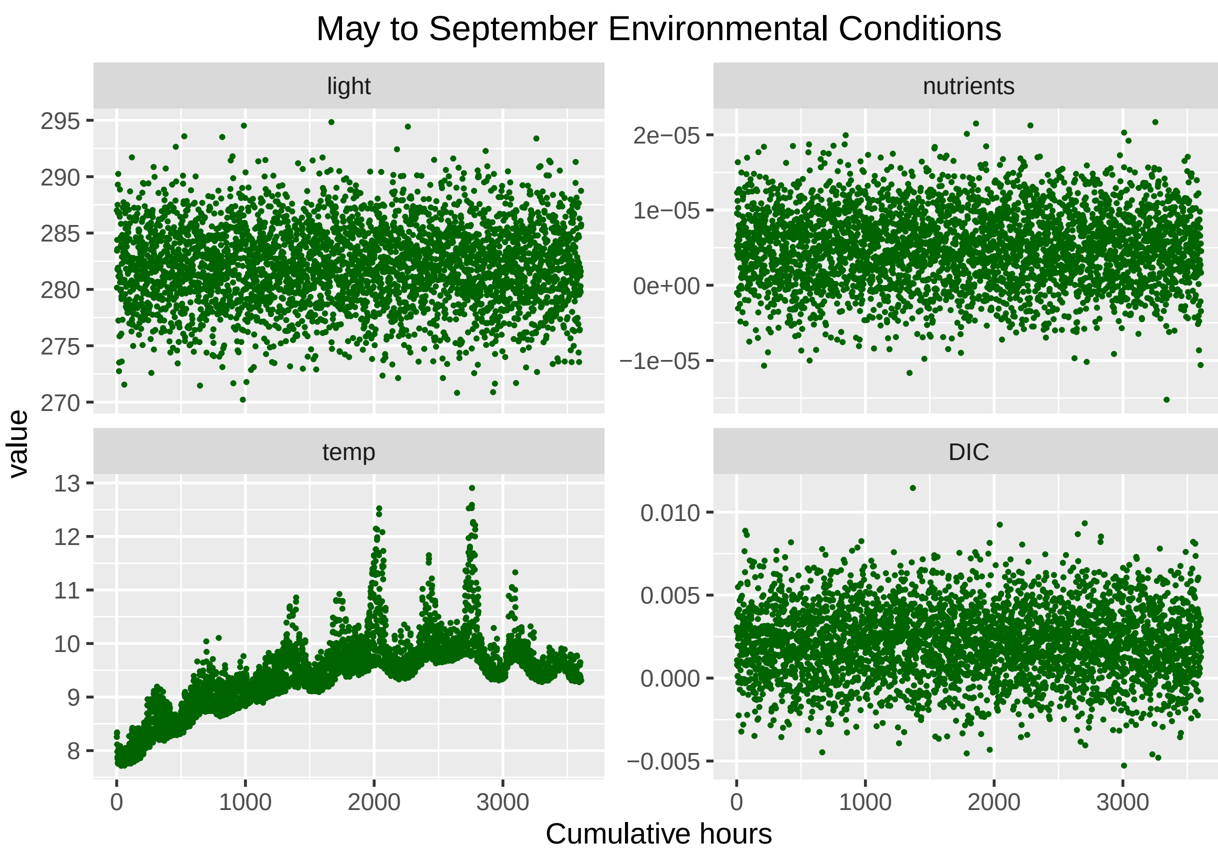

Figure 2: Preliminary Drivers of the Dynamic Energy Budget Model - BATI5

Results

Environmental layers are passed through a compilied DEB. The DEB produces quite a bit of output.

Next step is to figure out how to estimate change in DIC from the output data, along with a measure of total plant size. This would include using below-bulb stype diameter to estimate stype mass, plus some number of fronds to multiply by the growth value. (These fronds will need to be shed at some rate … see Canvin et al. 2024).

Fin.

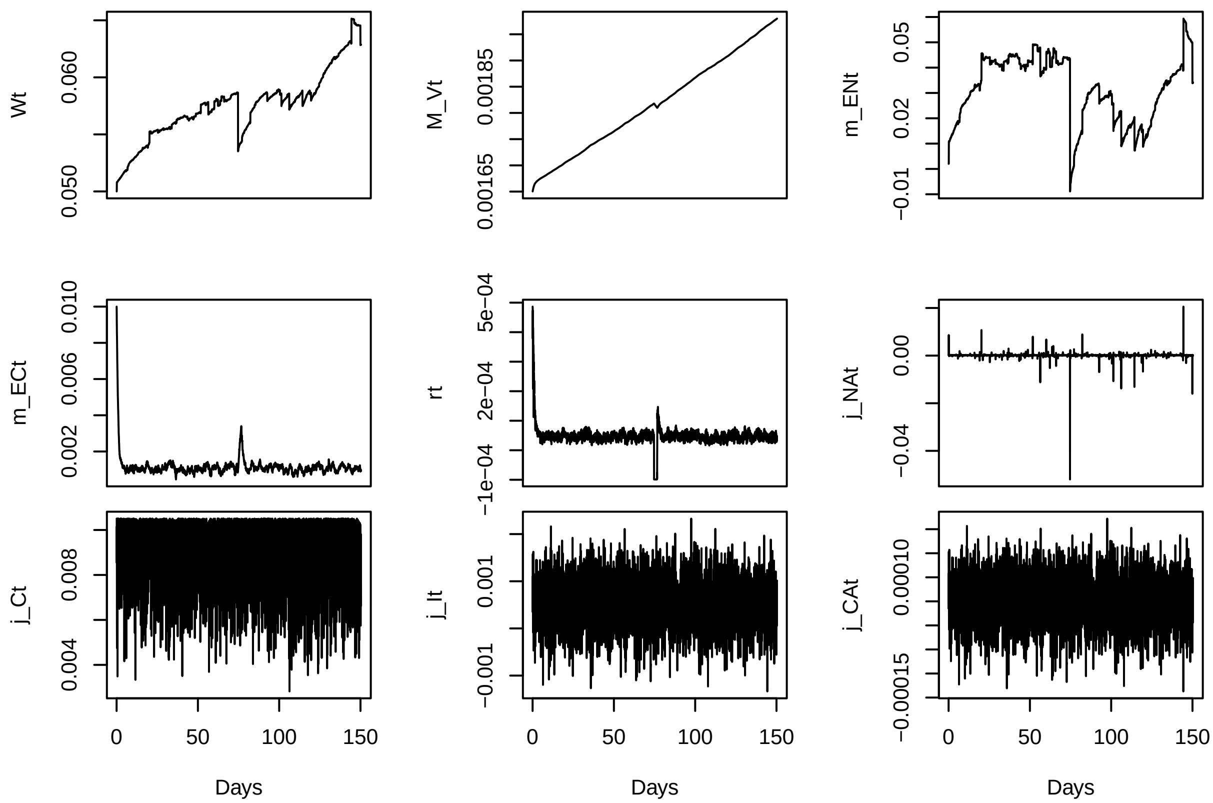

Figure 3: Output from the DEB model - BATI5

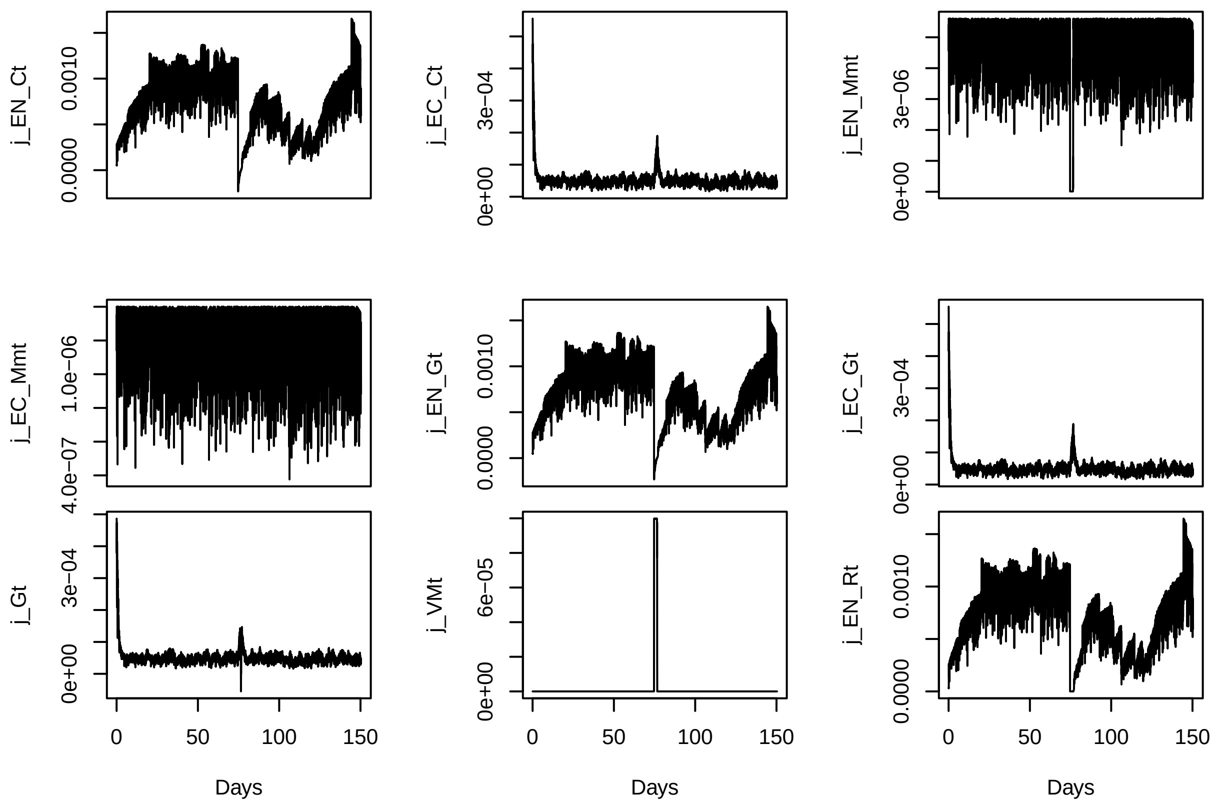

Figure 4: Output from the DEB model - BATI5

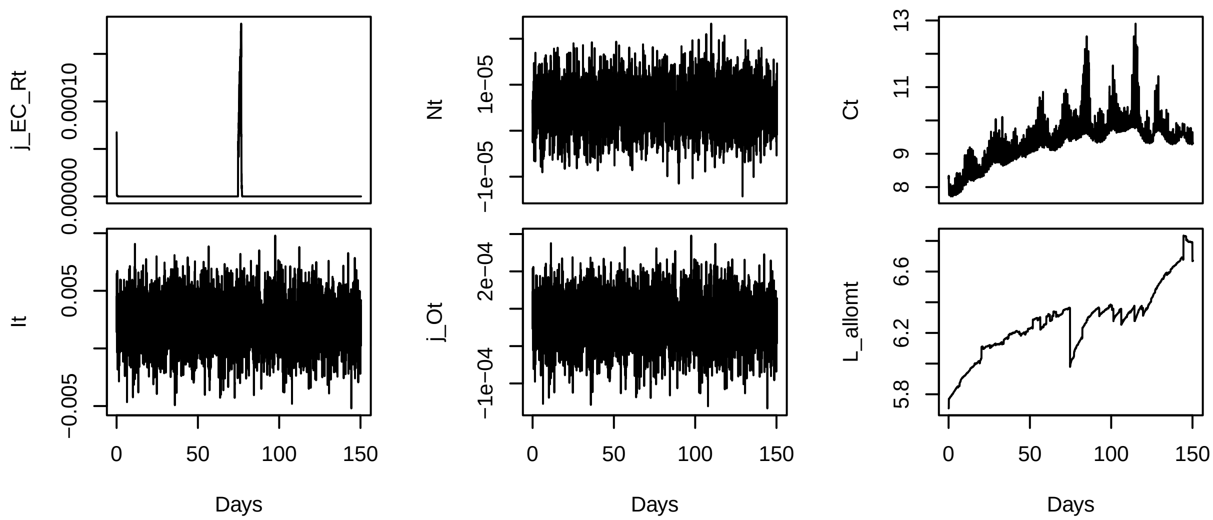

Figure 5: Output from the DEB model - BATI5