NPZD-nitrogen-isotope model, adapted from Sarmiento and Gruber (2006) and Yoshikawa et al. (2005)

Diagram

Description automatically generated

**NPZD-model:**

With each biological process is determined as follows:

**NPZD-15N model:**

**NPZD-14N model**:

Isotopic fractionation coefficient:

Since modeled 14N have to be divided by 0.366% to represent 15N/14N of atmospheric N, δ15N can simply be defined as

**Model parameters:**

Simulation of environment parameters with time:

Seasonal MLD : )

Entrainment:

Seasonal light:

Average ML light:

|  |  |  |  |
| --- | --- | --- | --- |
| Vmax | Phytoplankton maximum photosynthetic rate | 2 | day-1 |
| KNUT | Phytoplankton half saturation constant | 2 | µmol/m3 |
| lP | Phytoplankton mortality rate | 0.05 | day-1 |
| Kp |  | 2.8 | µmol/m3 |
| α | Zooplankton assimilation efficiency | 0.7 | nodim |
| β | Zooplankton growth efficiency | 0.3 | Nodim |
| g | Zooplankton grazing rate | 1.4 | day-1 |
| lZ | Zooplankton mortality rate | 0.12 | day-1 |
| lD | Detritus remineralization rate | 0.05 | day-1 |
| Wsink | Detritus sinking rate | 10 | day-1 |
| c | Background mixing rate | 0.01 | day-1 |
| h0 |  | 50 | m |
| h1 |  | 100 | m |
| I0 |  | 20 | W/m2 |
| I1 |  | 150 | W/m2 |
| zI |  | 20 | m |
| KI |  | 80 | W/m2 |
| fPAR |  | 0.4 |  |
| 15Nlow | Natural abundance of deep water 15N | 1.005 |  |
| ϵuptake | Discrimination factor of nitrate uptake | -5 | ‰ |
| ϵexcretion | Discrimination factor of zooplankton excretion | -1 | ‰ |
| ϵegestion | Discrimination factor of zooplankton egestion | -1 | ‰ |
| ϵremineralization | Discrimination factor of remineralization | -1 | ‰ |