**Response variables of potential interest**

**(black – plots already produced by code, red – not calculated/produced currently)**

Algal biomass

* Cross-radial profile of pelagic and benthic algal biomass (plots of concentrations)
* Cross-radial profile of depth-integrated total (= pelagic + benthic) algal biomass per area
* Average pelagic algal biomass *per volume* of lake water
* Average pelagic and benthic algal biomass *per lake area*(= standing stock of algae)
* Contribution of benthic algae to total algal biomass in the lake

Algal primary production = *pA(x, z)*, *pB(x)*

* Cross-radial profile of specific [*pA(x, z)*, *pB(x)*] and total [*pA(x, z)·A(x, z)*, *pB(x)·B(x)*] primary

(tillväxtermer, obs exclusive förluster)

* production of pelagic and benthic algae (total per lake mgC/day)
* Average pelagic, benthic and total (= pelagic + benthic) primary production per area
* Contribution of benthic algal production to total primary production in the lake

Algal limitation

* Cross-radial profile of nutrient- vs. light-limitation of algal production (log kvoten ist för binärt till exempel, med gränsen utmarkerad)
* Proportion of lake volume/lake bottom where algal production is light-limited
* Depth of light limitation of benthic algae (measured at the sediment surface) and of pelagic algae (measured at the deepest spot of the lake, *x* = 0) (z\_max already calculated)
* Average sedimentation loss rate of pelagic algae (= flux to the sediment divided by standing stock in the lake) (alternativt andelen förluster pga. utsjunkande relativt totala förlusterna)

Nutrients

* Concentration of mineral nutrients = *R* (cross-radial profile; average concentration across the lake)
* Concentration of total nutrients in the water column = *qAA* + *qDD* + *R* (cross-radial profile; average concentration across the lake)
* Cross-radial profile of nutrients accumulated in the sediment

Nutrient distribution among compartments

* Contributions of pelagic algae, detritus and mineral nutrients to total nutrients in the water column (average across the lake) = *qDD*/( *qAA* + *qDD* + *R*) etc. (vilken andel av näringen I vattenmassan är bunden I detritus, lost näring, och alger?)
* Contribution of pelagic and benthic algae, sediment, detritus and mineral nutrients to total nutrients in the lake

**Environmental parameters of potential interest**

*Rtot* – total nutrients in the system = sum of dissolved nutrients and nutrients in sediment, detritus and benthic/pelagic algal biomass [g P/m2or g P/m3]

For a closed system, there are at least two possibilities:

* Total nutrients *per area* is kept constant across lakes of different dimensions and morphometries [g P/m2]
* Total nutrients *per volume of water* is kept constant [g P/m3]

*Kbg* – coefficient of background light attenuation = light attenuation by all dissolved and particulate matter that is neither algal biomass nor detritus [1/m]

*zmean* – average lake depth = mean depth of the lake, averaged across the surface area of the lake [m]

*ODmean* – average optical depth = *Kbg·zmean*

*Vcomp* – proportion of lake volume that is below the compensation depth, i.e. the water depth below which light-limited algal growth is negative in an empty system [dimensionless]

*alpha* – shape parameter describing the depth profile of the lake bottom

maximum lake depth

lake size (area)

horizontal and vertical turbulence

euphotiska djupet (maximala överlevnadsdjupet, z\_max som plottas redan)

kvoter: (snittdjup/maxdjup, bredd/snittdjup, etc.)

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Additional thoughts

Since immediate mortality of pelagic algae at the sediment surface is a pretty strong assumption, we could look into an alternative where we assume that benthic and pelagic algae are actually the same population. This would mean that pelagic algae do not become sediment nutrients but become benthic algae when they sink to the bottom. Sinking to the bottom thus becomes an immigration term to the benthic population.

Another debatable assumption is that only sediment gets resuspended, but not benthic algae. We could assume that benthic algae also get resuspended. Either at the same rate as sediment or at a lower rate (assuming that a biofilm is more resistant to resuspension). Immediately after resuspension, benthic algae would then be counted as pelagic algae, in the same way as resuspended sediment becomes pelagic detritus.

It seems as if, in many lakes, benthic algal biomass is not highest in the most shallow areas, and in some lakes a maximum of chlorophyll seems to occur at considerable depth. The ‘deep chlorophyll maximum’ may thus be of some empirical interest. We should therefore explore a bit more how robust this finding of a deep chlorophyll maximum is against modifications of our somewhat unrealistic assumptions concerning the vertical and horizontal turbulence profiles and sediment resuspension. For example,

* run the model with a resuspension rate that decreases with depth
* run the model with a vertical turbulence profile that mimics a thermally stratified lake

We might also want to include seasonality, e.g.

* run the model with a seasonally changing light input
* run the model with a full vertical and horizontal mixing event once per year

All of these things could be combined in various permutations to see whether we still observe a benthic algal depth distribution with a maximum at some intermediate depth. With temporal variability, such a maximum may become less steep and pointy, which is more what real data look like.