Data-requirements for application of DYRESM-CAEDYM

When applying the DYRESM-CAEDYM model, a series of configuration- and boundary-condition data is required, as well as water chemistry and biota data collected from the lake for calibration and validation. For further DYRESM-CAEDYM information (download, manuals, and restrictions on use) see: http://www.cwr.uwa.edu.au/software1/models1.php?mdid=1.

The data-requirements can be divided into:

1. Configuration and boundary-conditions:

a) Morphology (hypsographic curve relating accumulated sediment area to discrete lake depths)
b) Meteorological data (grid-data and/or station data)
c) Inflow- and outflow-volumes (for surface streams as well as residual/groundwater, which can be estimated from a water balance)
d) Inflow-concentrations (chemistry) and temperature (for surface streams as well as residual/groundwater)

2. Water chemical, physical and biological data (for calibration and validation):

a) The more data the better (this part is flexible)! Data must be available/collected for the same time period from where boundary conditions (as listed above) are also available. General data requirements are time-series, preferably collected at **monthly intervals** or more frequently for a time-period of, **at the very least**, **2 years**, of:
    a. Temperature and DO profiles,
    b. Nutrients (various fractions) – if the lake is deep then samplings at two or more depths (representing epilimnion and hypolimnion respectively)
    c. Surface/epilimnion total chlorophyll *a*, and preferably phytoplankton biomass (in chlorophyll *a* or carbon) divided into functional groups (e.g., diatoms, greens, cyanos etc)
    d. Surface/epilimnion zooplankton biomass divided into functional groups (e.g., cladocerans, cal. copepods, cyc. copepods, and rotifers)
    e. Sediment nutrient content (various fractions) as well as organic and water content
    f. Macrophyte data (e.g., biomass per area, average coverage, max depth)
    g. Fish biomass data (estimated dry-weight or carbon biomass in the lake of the main piscivorous, planktivorous and omnivorous fish groups – yearly or seasonal estimates may suffice)
    h. Secchi depth
    i. Water level

On the following pages, please find a table describing the specific data required for application of the model (table may be used as a check-list)

Configuration and boundary-condition data

Data type	Variables and units red: critical (must have) yellow: important green: optional (but good to have)	Sampling frequency	Mark with X if available	Notes
Morphology (physical configuration)	**Hypsographic curve of the lake - relation between accumulated sediment area (m^2) to discrete lake depths (m)**	**Once**		See DYRESM user manual for example
Meteorology (boundary condition)	**Air temperature (ºC)** **Wind speed ($m\ s^{-1}$)** **Short wave solar radiation ($W\ m^{-2}$)** **Cloud cover (%)** **Relative humidity (%)** **Precipitation ($m\ day^{-1}$)**	**Daily averages**		Can be from a nearby station or from an interpolated grid Meteorological data can also be used on a sub-daily basis (for example, if high frequency buoy data is available)
Alternative/optional meteorology (boundary condition)	**Long wave solar radiation ($W\ m^{-2}$)** **Vapour pressure (hPa)** **Wind direction (degrees)**	**Daily averages**		Can be from a nearby station or from an interpolated grid
Inflow volumes (flow boundary)	**$m^3\ day^{-1}$**	**Daily averages**		Must be for all the individual inflows (at least those contributing considerably to the water balance) *Note:* if continues flow-gaugings are not available, daily values can be derived from linear interpolation between monthly samplings
Inflow physics (flow boundary)	**Temperature (ºC)**	**Daily averages**		Must be for all the individual inflows (at least those contributing considerably to the water balance) *Note:* daily values can be derived from linear interpolation between monthly samplings

Inflow chemistry (flow boundary)	**DO (mg O_2 L^{-1})** **TN (mg N L^{-1})** **NO_3 (mg N L^{-1})** **NH_4 (mg N L^{-1})** **PON (mg N L^{-1})** **DON (mg N L^{-1})** **TP (mg P L^{-1})** **PO_4 (mg P L^{-1})** **POP (mg P L^{-1})** **DOP (mg P L^{-1})** **SiO_2 (mg Si L^{-1})** **POC (mg C L^{-1})** **DOC (mg C L^{-1})** **pH (-)** **SS (mg SS L^{-1})** **ISS (mg ISS L^{-1})** **Salinity (Practical Salinity Scale, pss)**	**Daily averages**	Must be for all the individual inflows (at least those contributing considerably to the water balance) *Note:* daily values can be derived from linear interpolation between monthly samplings. PON/DON and POP/DOP may be estimated from TN, NO_3 and NH_4, and TP and PO_4, respectively. PON = particulate organic N DON = dissolved organic N POP = particulate organic P DOP = dissolved organic P POC = particulate organic C DOC = dissolved organic C SS = suspended solids ISS = inorganic SS
Outflow volumes (flow boundary)	**m^3 day^{-1}**	**Daily averages**	*Note:* if continues flow-gaugings are not available, daily values can be derived from linear interpolation between monthly samplings

Water chemistry, physical and biological data (for calibration and validation)

Data type	Variables and units red: critical (must have) yellow: important green: optional (but good to have)	Sampling frequency	Mark with X if available	Notes
Lake water physics (in-lake data)	Temperature (°C) Secchi depth (m) Water level (m)	Monthly samples (or more frequent)		
Lake water chemistry (in-lake data)	DO (mg O_2 L^{-1}) TN (mg N L^{-1}) NO_3 (mg N L^{-1}) NH_4 (mg N L^{-1}) PON (mg N L^{-1}) DON (mg N L^{-1}) TP (mg P L^{-1}) PO_4 (mg P L^{-1}) POP (mg P L^{-1}) DOP (mg P L^{-1}) SiO_2 (mg Si L^{-1}) POC (mg C L^{-1}) DOC (mg C L^{-1}) pH (-) SS (mg SS L^{-1}) ISS (mg ISS L^{-1}) Salinity (Practical Salinity Scale, pss)	Monthly samples (or more frequent)		
Lake water biology (in-lake data)	Phytoplankton biomass (µg Chl *a* L^{-1}) Phytoplankton biomass (mg C L^{-1}) Zooplankton biomass (mg C L^{-1}) Fish biomass (mg C L^{-1}) Macrophyte biomass (mg C m^{-2})	Monthly samples (or more frequent)		Phytoplankton-, zooplankton- and fish-biomass data must be divided/separated into main functional groups, e.g.: - diatoms, greens, cyanos etc. for phyto - cladocerans, cal. copepods, cyc. copepods and rotifers for zooplankton - piscivores, planktivores and omnivores for fish

Note that the assigned color codes (red, green and yellow) are subject to expert opinion and may differ somewhat between scientists and between model applications.