

Variability in night –time patterns in community respiration

Background

- People have long recognized that there is variability in community respiration rates depending on when in the day you make the measurement.
- Over the past twenty years, there have been a couple handfuls of studies which have explicitly evaluated these patterns.
- Most have focused on eutrophic systems because of the ease of measuring changes in DO.
- None have assessed the variability in these patterns across a large sample of lakes representing a wide range of trophic and/or DOC conditions.

Objectives

- GLEON 9 discussion topic was diel variability in respiration and the power in existing GLEON datasets to address some questions
- GLEON lake dataset provides a unique opportunity to evaluate overnight patterns in community respiration utilizing existing dissolved oxygen data spanning 25 lakes

Questions

- Are there consistent patterns in community respiration within individual lakes
- How do those patterns vary across lakes of differing trophic status
- What is the relationship on a diel scale between PAR and night time community respiration (are sunny days different from cloudy days within a lake)

Questions

- Can we discern mechanisms of control using a correlative approach with other physical, environmental, and limnological variables

Goals for GLEON 10

- Using preliminary dataset (N=7) evaluate representative data for variability in nighttime patterns in CR
- Discuss
 - approaches for quantifying patterns
 - logistical constraints of data (i.e., does variability in DO due to physical lake processes prevent us from saying anything definitive about patterns that are biologically driven?)

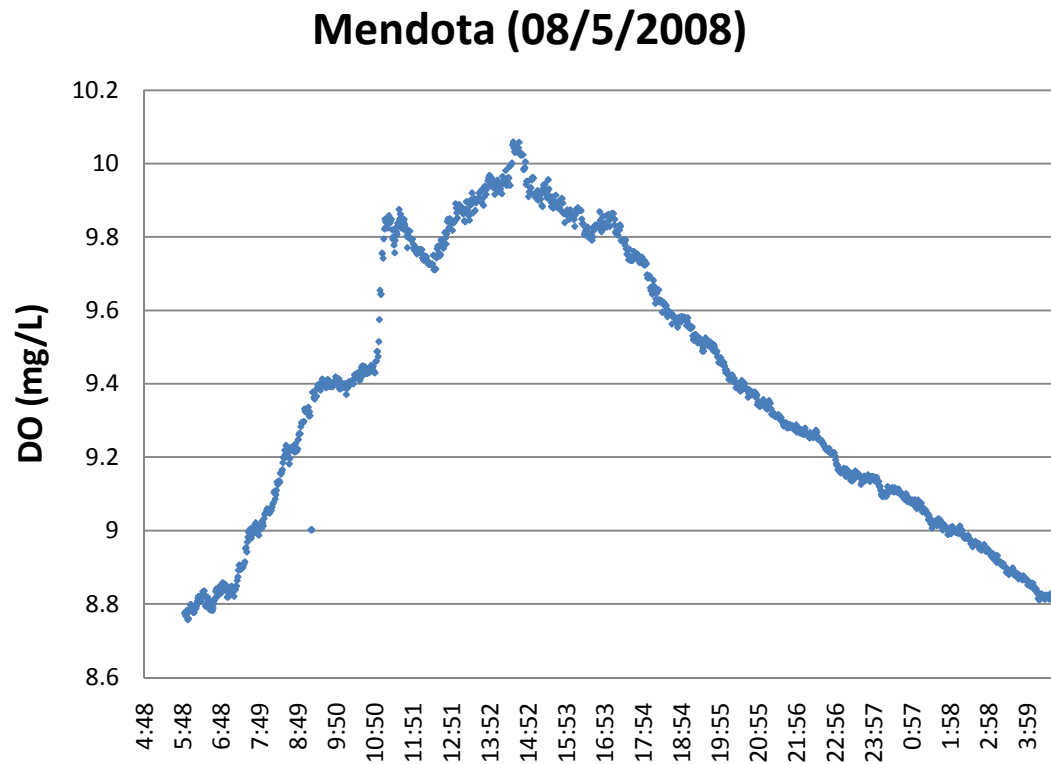
Goals for GLEON 10

- Discussion points
 - approaches for quantifying patterns
 - logistical constraints of data (i.e., does variability in DO due to physical lake processes prevent us from saying anything definitive about patterns that are biologically driven?)
 - Preliminary analysis

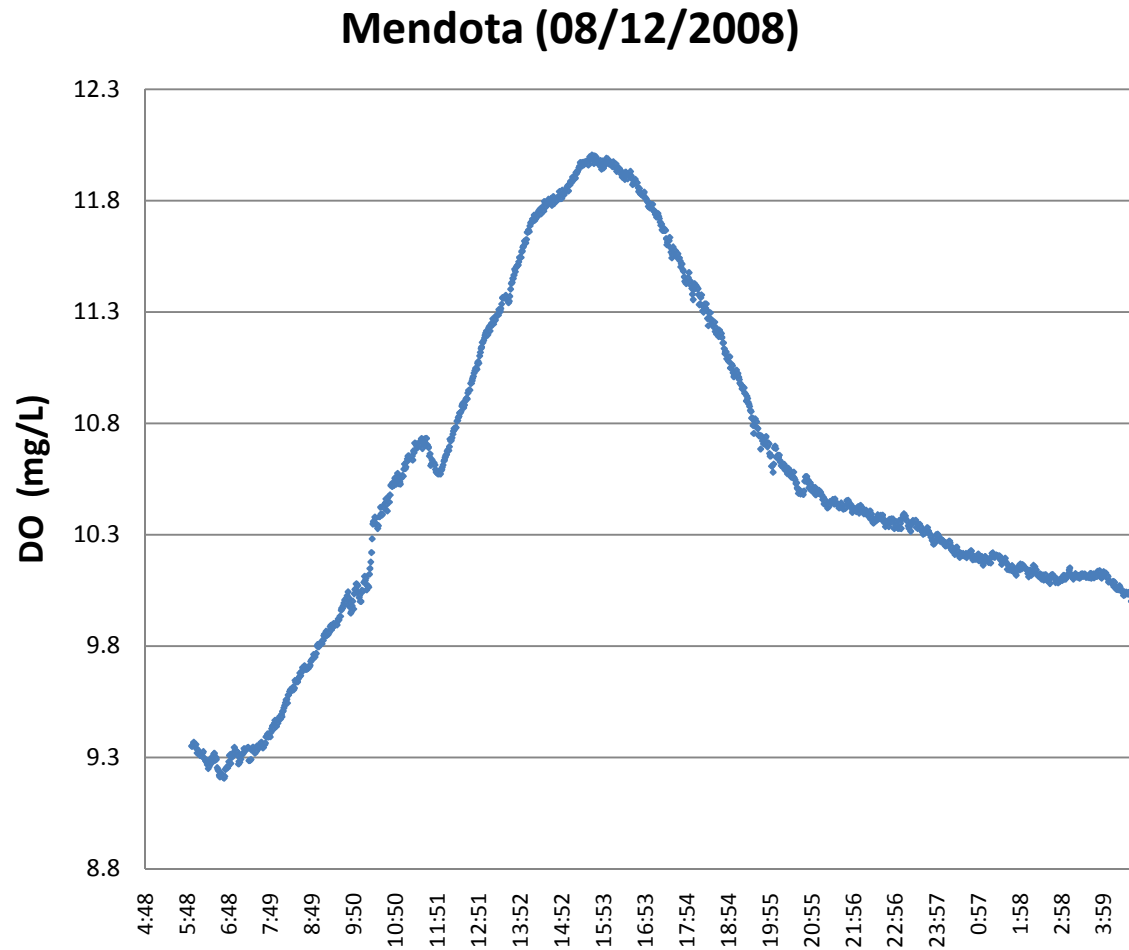
Approach

- Select days where biology is dominating DO signal
- Extract data from those days where $R > P$ and DO is declining
- Using a statistical model identify breaks in draw down of dissolved oxygen
- Estimate break points (timing of the period of respiration)

Preliminary Results: patterns among lakes



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Preliminary Results: patterns among lakes

Lake	N	Trophic State	Respiration Pattern
Sparkling	4	Oligotrophic	Linear
Mendota	5	Eutrophic	Linear, Biphasic
Trout	3	Oligotrophic	Linear
Crystal Bog	4	Oligotrophic	Linear
Acton	5	Eutrophic	Linear
Rodorua	4	Oligo-Mesotrophic	Linear, Biphasic

Approach

- Estimate rates based slope
- Correlate rates from individual days with other daily time scale parameters (within and across lakes)

Preliminary Results: example of model fit

$$\begin{aligned} \text{If } x < i \{ \\ & y = y_0 + a_1 x \} \\ \text{else} \{ \\ & y = y_0 + (a_1 - a_2) i + a_2 x \} \end{aligned}$$

Fit

y_0 = intercept

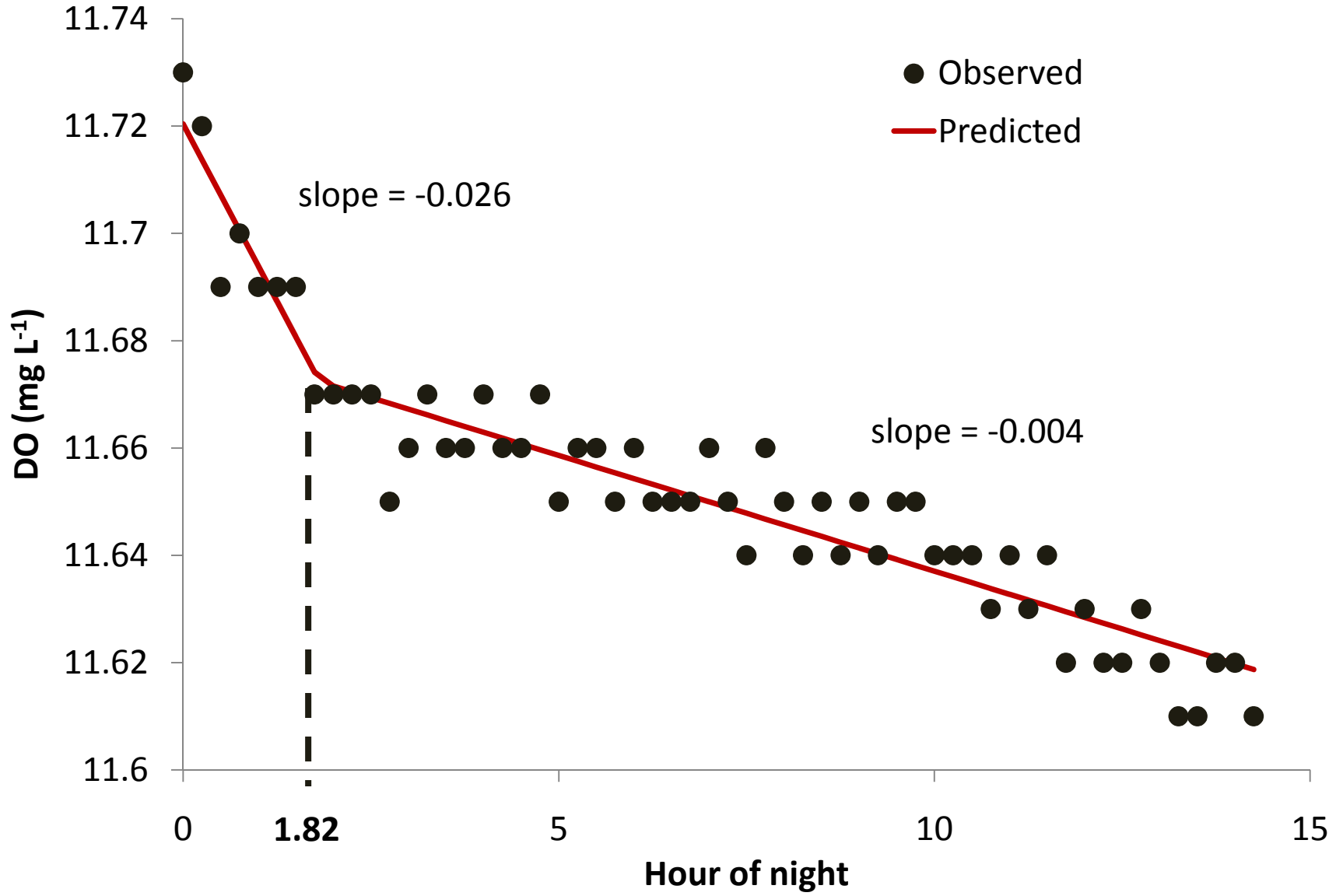
a_1 = 1st slope

a_2 = 2nd slope

i = break point

Lake Rotorua

August 4 2007



Future Plans

- Reconvene in June at ASLO with entire group to:
 - Share preliminary results
 - Discuss data limitations
 - Discuss approaches for quantifying patterns
 - Consider existing research questions and decide if they are appropriate to data or if they need to be reframed
 - Secure permission to use entire dataset

Deliverables

- By ASLO
 - Organize preliminary data into a brief report

Schedule

- June 2010: mini-meeting at ASLO
- July – December: meetings kanoodle with data
- December 2010: Working group meeting
 - finish analysis on entire dataset
 - Assign writing
- 2011: GLEON 12 meeting
 - distribute draft M.S. for review within group