Hydrogen Sulfide Anaerobic Lagoons (IBP)

John Walton

Animal Processing

- Very high organic matter loading to open lagoons
- Much higher loading than sewage
- Oxygen rapidly used up
- Organic sulfur decomposed to hydrogen sulfide

Shallow Lagoon

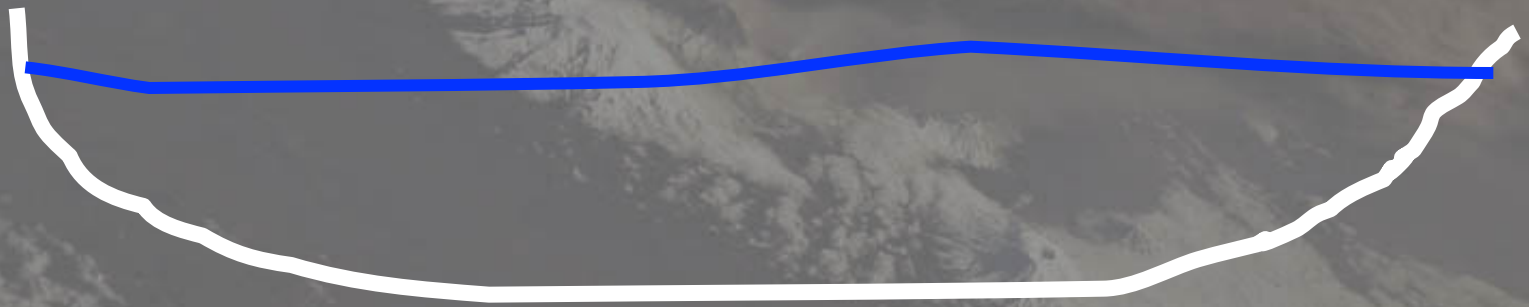
What direction are fluxes of:

hydrogen sulfide

oxygen

carbon dioxide

methane



Fluxes

- Proportional to fugacity (escaping tendency, partial pressure) in water versus aqueous phase
- Escape by bubbling
- Escape by normal liquid/gas mass transfer

What is the pressure for bubble formation?

- Does it change with depth?
- If so, how?
- What is in the bubbles?
- Sum the partial pressures of methane, CO2, and H2S

How does release of H2S and CO2 depend upon pH?

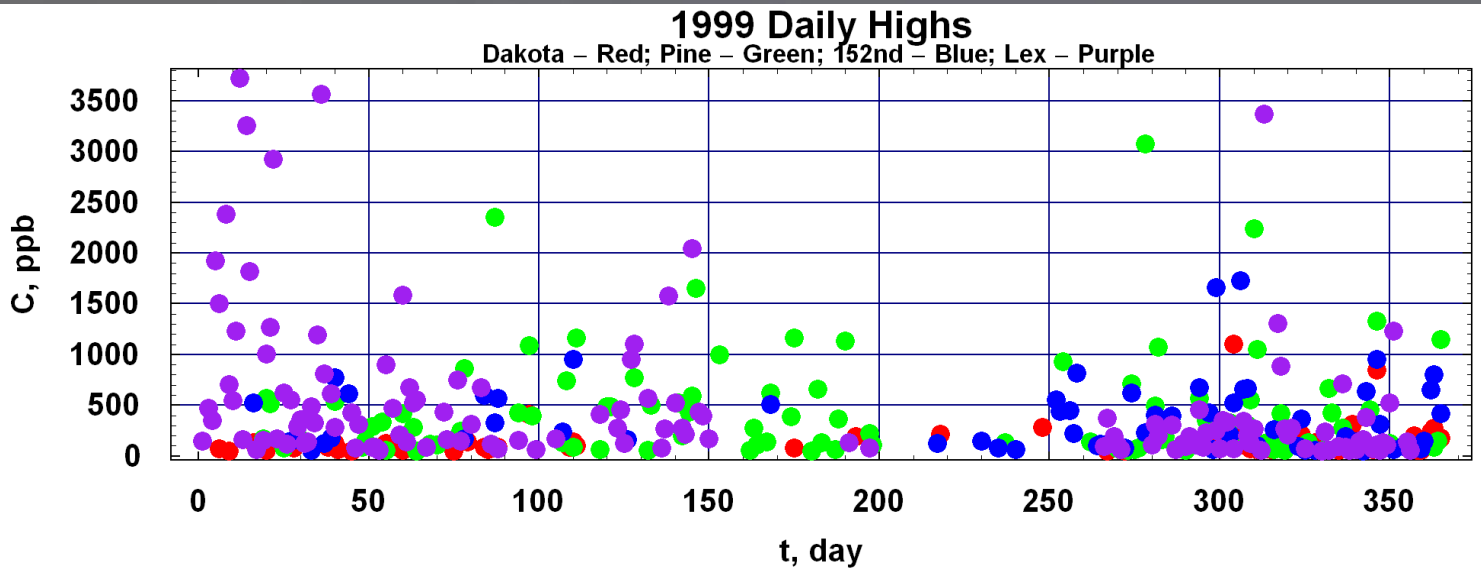
- Only the uncharged species are released into the gas phase.
- How does pH of most surface waters in euphotic zone change diurnally?
- Lower pH (night) leads to greater fraction uncharged, greater release

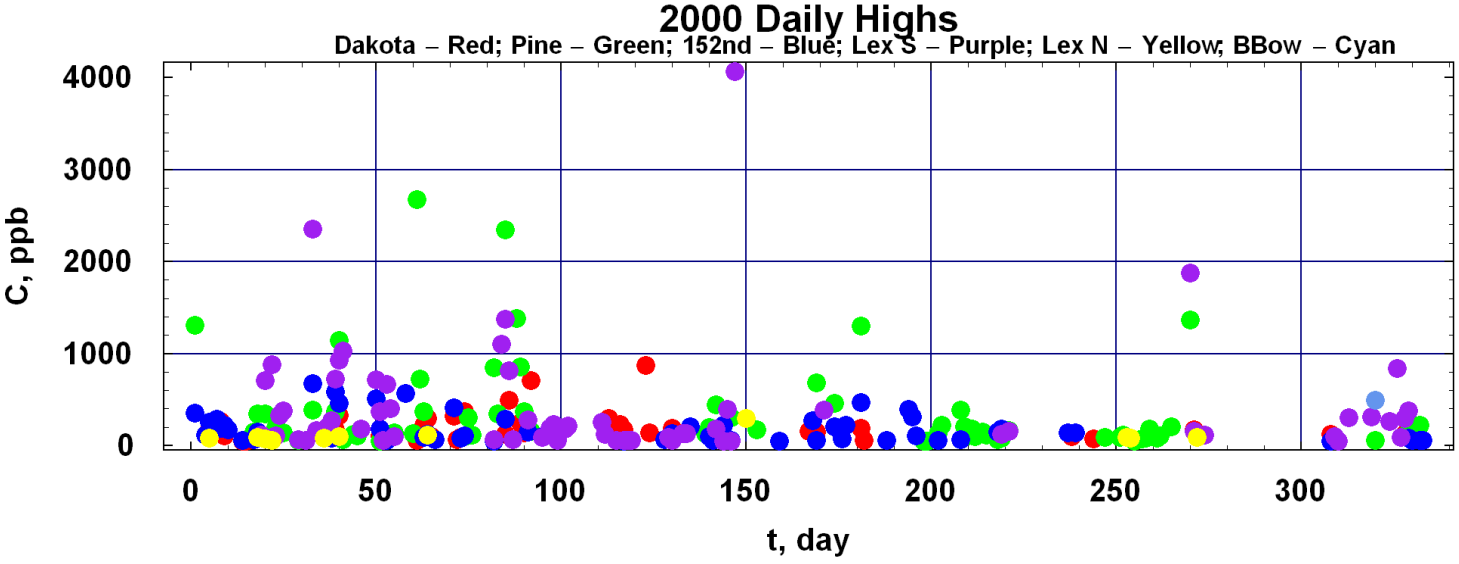
How does mixing change diurnally?

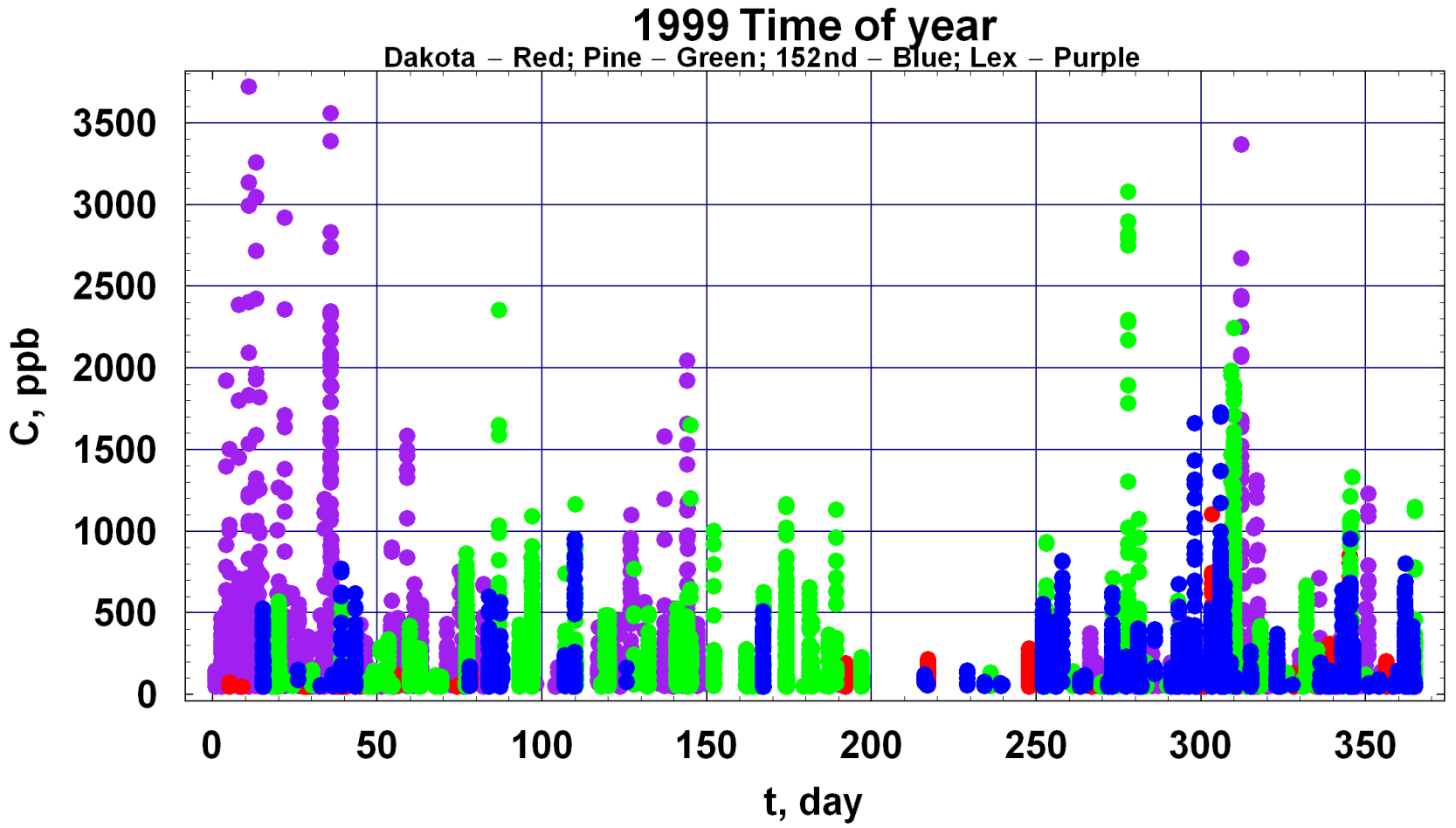
- Warm sun during day warms surface waters – very stable, little mixing
- Cooling at night causes deeper mixing
- High winds also cause mixing (but also greater atmospheric dispersion

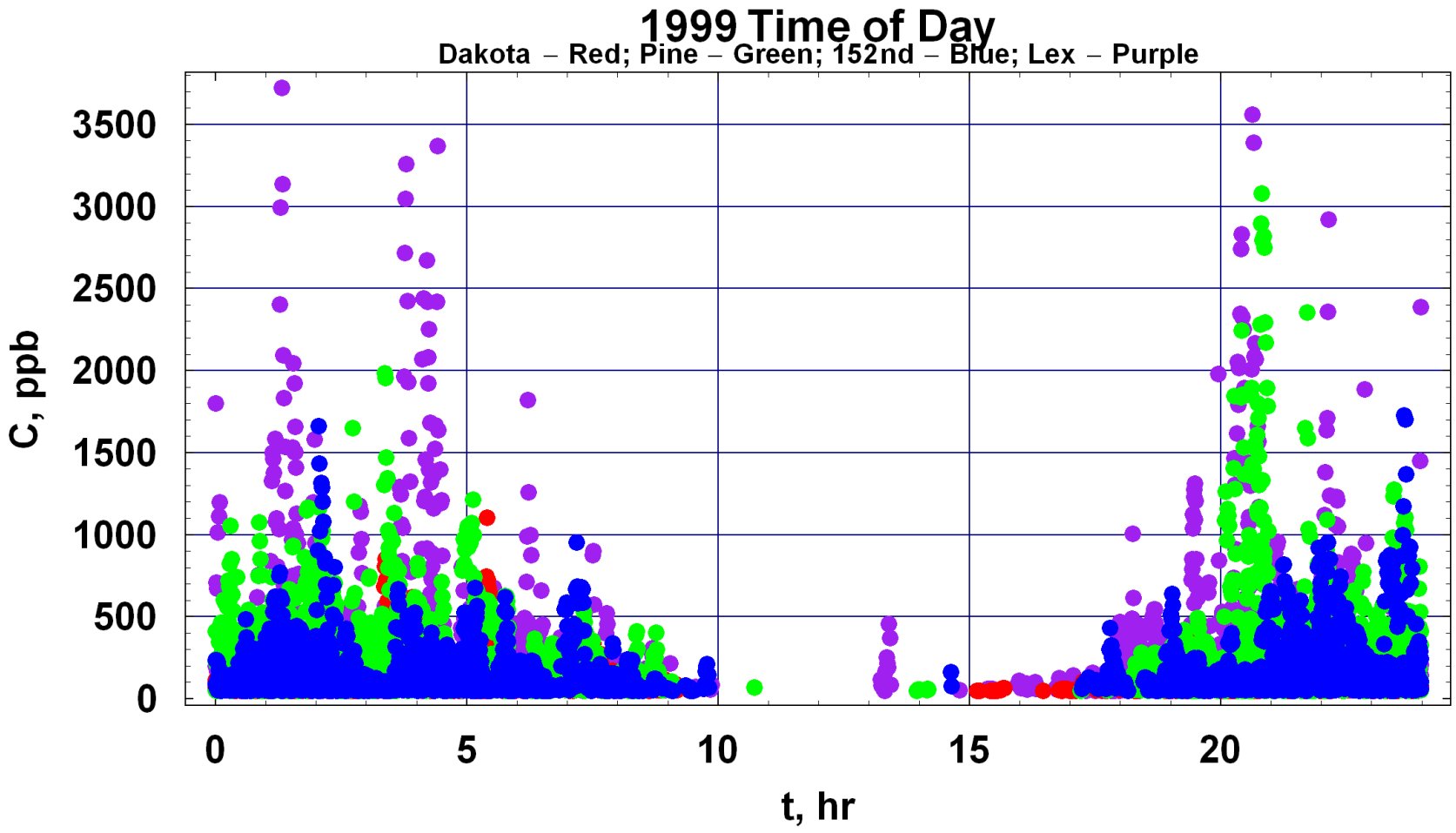
Atmospheric Stability

- Atmosphere more stable at night
- Lower dispersion means higher concentration per unit emission


1999 Daily Highs
Dakota – Red; Pine – Green; 152nd – Blue; Lex – Purple
C, ppb
3500
3000
2500
2000
1500
1000
500
0
0
50
100
150
200
250
300
350
t, day


2000 Daily Highs
Dakota – Red; Pine – Green; 152nd – Blue; Lex S – Purple; Lex N – Yellow; BBow – Cyan
C, ppb
4000
3000
2000
1000
0
0
50
100
150
200
250
300
t, day


1999 Time of year
Dakota – Red; Pine – Green; 152nd – Blue; Lex – Purple
C, ppb
3500
3000
2500
2000
1500
1000
500
0
0
50
100
150
200
250
300
350
t, day


1999 Time of Day
Dakota – Red; Pine – Green; 152nd – Blue; Lex – Purple
C, ppb
3500
3000
2500
2000
1500
1000
500
0
0
5
10
15
20
t, hr