Concentration, units & dimensions

Learning Objectives:
- Define Environmental Fluid Mechanics (EFM)
- List and define three types of concentration measures
- List the dimensions of concentration, mass fraction, and the diffusion coefficient
- Convert concentration measures among various units (i.e. mg/l to mol/l)

Motivational Question:
- How do you quantify the amount of a chemical dispersed in the environment?
Examples of Environmental Fluid Mechanics Projects

OCEN 489 and 689
Scott A. Socolofsky
Environmental Fluid Mechanics

- Definition: Answers to how natural processes in the hydrosphere change concentrations
- Transport processes:
  - Diffusion (molecular and turbulent)
  - Advection
  - Convection
- Transformation processes: (key processes)
  - Dissolution
  - Chemical reactions
  - Critter metabolisms
Concentration boundary layer. Turbulence structure is clearly evident.

Waves collage courtesy of John Crimaldi
Hydromechanics

Breaking waves move sediment, generate sea spray, oxygenate the water column and provide turbulence, among other important coastal and offshore processes.

Courtesy of Benoit Cushman-Roisin, Dartmouth College

TEXAS A&M ENGINEERING
Point Pollution Sources

Shoreline Contact
Outfall Location

Wastewater Outfalls

Courtesy of the CORMIX project
Non-Point Pollution Sources

MAJOR NPS POLLUTION SOURCES

Urban
Oil, Gas, Battery Acid, Household Chemicals & Detergents

Agriculture
Manure, Nutrients, and Pesticides

Forests
Sediment and Pathogens from Animal Fecal Matter

Sewage, Chemicals, and Carcinogens

Point Sources

Courtesy of Roanoke County, VA

TEXAS A&M ENGINEERING
Storm Water Runoff

Pollutant loads include point and non-point sources

Courtesy of USGS

TEXAS A&M ENGINEERING
Accidents

Deepwater Horizon oil-well Blowout

Fukushima nuclear disaster
Water Quality

Measurement of a wealth of water quality parameters

Courtesy of Cortland College

TEXAS A&M ENGINEERING
Zooplankton, phytoplankton, and other lake inhabitants

Courtesy of Gertrud Cronberg
Natural Preservation

Restoration and Provision for Natural Conditions

Courtesy of College of Natural Resources, University of Idaho
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<td>• Diffusion</td>
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<td>• Advection</td>
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<td>• River Mixing Processes</td>
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