Applications Tip of the Week

Dissolved Oxygen measurement at high altitude

Question:
• How does high attitude affect dissolved oxygen levels?
• Can we measure dissolved oxygen (DO) at 4500 meters above the sea level with the Orion Star Plus DO Meter?

Answer:
• The saturated dissolved oxygen (DO) concentration in water is dependent on a number of factors including temperature, atmospheric pressure/altitude, and salinity. “Saturation” refers to the maximum amount of oxygen that water can hold; it is the equilibrium point at which water becomes saturated with oxygen.

• The dissolved oxygen probe/meter system measures the partial pressure of oxygen in water. The percent of oxygen in the atmosphere is 20.9%, which means that, with a barometric pressure of 760 mm Hg, 160 mm Hg is contributed by oxygen. When the barometric pressure changes as a result of altitude changes, the partial pressure of oxygen also changes. For example, at an altitude of 4500 meters above sea level the barometric pressure will drop to 435 mm Hg, and the partial pressure of oxygen will be 91 mm Hg (435*0.209=90.9).

• DO solubility in saturated water at any one temperature, barometric pressure, and salinity has been measured by many scientists over the years and presented in tables. These tables are built in modern instruments such as the Thermo Scientific Orion Star Plus DO and RDO Meters. A chart below (page 2) is an example to demonstrate the oxygen solubility in fresh and sea water at different altitudes above sea level at a temperature of 25 degrees Celsius.

• The Orion Star Plus DO and RDO Meters have an internal barometer that is used to measure barometric pressure. The measured oxygen partial pressure is converted into concentration terms (mg/L) by using the solubility value of oxygen at the specific atmospheric pressure, temperature, and salinity.

• By default, the Orion DO Meters compensate for the atmospheric pressure automatically. There is also an option for the manual barometric pressure compensation if desired.
Oxygen solubility in fresh and sea water at different altitudes above sea level (T=25 degrees Celsius)

DO solubility, mg/L

Altitude above sea level, meters

Fresh water, salinity=0
Sea water, salinity=35