



The diagrams show only disturbances; there is also an unvarying trade wind that blows east to west.

In **El Niño** years, surface winds at the equator have an abnormal west to east (left to right) component, driving warm surface water against the coast of the Americas. Warm water and cloud cover keep the weather mild and moist.

In **La Niña** years, the weather pattern is the mirror image. Surface winds at the equator have an abnormal east to west (right to left) component, driving warm surface water away from the coast of the Americas. Cold upwellings and lack of cloud cover keep the weather cool and dry.

These weather disturbances are only quasi-stable, and the weather system in the Pacific flips from one to the other and back again over periods of 2–7 years in a seemingly random, but, in fact, predictable fashion.

Chen & al., *Predictability of El Niño over the past 148 years*, *Nature*, **428**, 733–736, 15 April 2004.

The El Niño- La Niña quasi-stable cycle has most effect in the southern Pacific Ocean, hence its acronym ENSO (El Niño Southern Oscillation) In the northern Pacific Ocean, there is in addition to the effects of the ENSO another quasi-stable cycle known as the Pacific Decadal Oscillation (PDO). The linkage between the ENSO and the PDO in the north is either weak, complicated, or both, and is not well understood. The PDO cycles at a lower rate than the ENSO—decades rather than just a few years.

The bad winter of 2010 and 2011 on Gabriola is most likely the result of the unusual circumstance of the ENSO and the PDO both being in their North American cold phases at the same time.