Taking Advantage of the Trade Winds on a 5000 km Sailing Trip

By Aarnout van Delden (IMAU, Utrecht University), June 2014
(http://news.imau.nl/?p=1740), (http://www.staff.science.uu.nl/~delde102/)

While a huge oceanic equatorial Kelvin wave was slowly propagating eastward from Indonesia to South America, Bert Boerema and Marion Ermers were meticulously preparing the biggest stage until now in their world wide sailing trip. Over a period of more than 10 years this sailing trip had brought them from their point of departure in the Netherlands to the beautiful Isles of Scilly, all around the Mediterranean and the Black Sea, Madeira, the Canary Islands, Brazil, the Caribbean, Panama Canal and, ultimately, to Baja California (Mexico), where they had lived for one year.

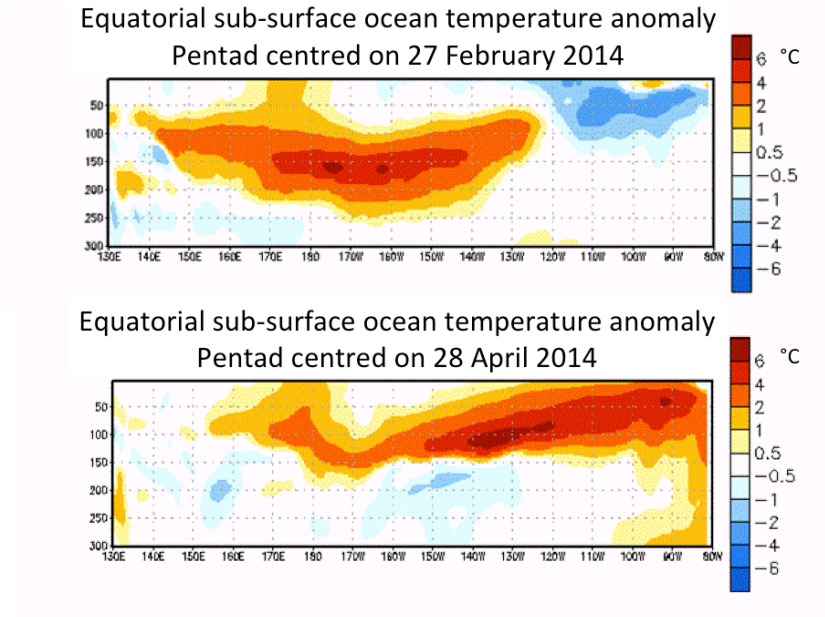

Figure 1. Depth-longitude section of equatorial Pacific upper ocean temperature anomalies (°C), averaged between 5°S and 5°N, centred on the pentad of 27 February 2014 (upper panel) and on the pentad of 28 April 2014 (lower panel). The anomalies are departures from the 1981-2010 base period pentad means (source: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/enso.shtml)

In February of 2014 the TAO/TRITON array of nearly 70 buoys, spanning the width of the equatorial Pacific Ocean, was monitoring the equatorial Kelvin wave. Measurements of the water temperature up to a depth of 300 m were clearly revealing an apparent sub-surface eastward movement of relative warm water (figure 1), which would upset the normal temperature distribution of the ocean and bring warm water to the surface of the Eastern Pacific and cool water to the surface of the Western Pacific. This rearrangement of the oceanic temperature distribution, called “El Niño”, affects the atmosphere by weakening the trade winds and bringing tropical cyclones in the south Pacific as far east as Tahiti, at 149°W and 18°S. The last major “El Niño” event was recorded in the years 1997-1998 (M.J. McPhaden, 1999: Genesis and evolution of the 1997-98 El Niño. **Science, 283**, 950).

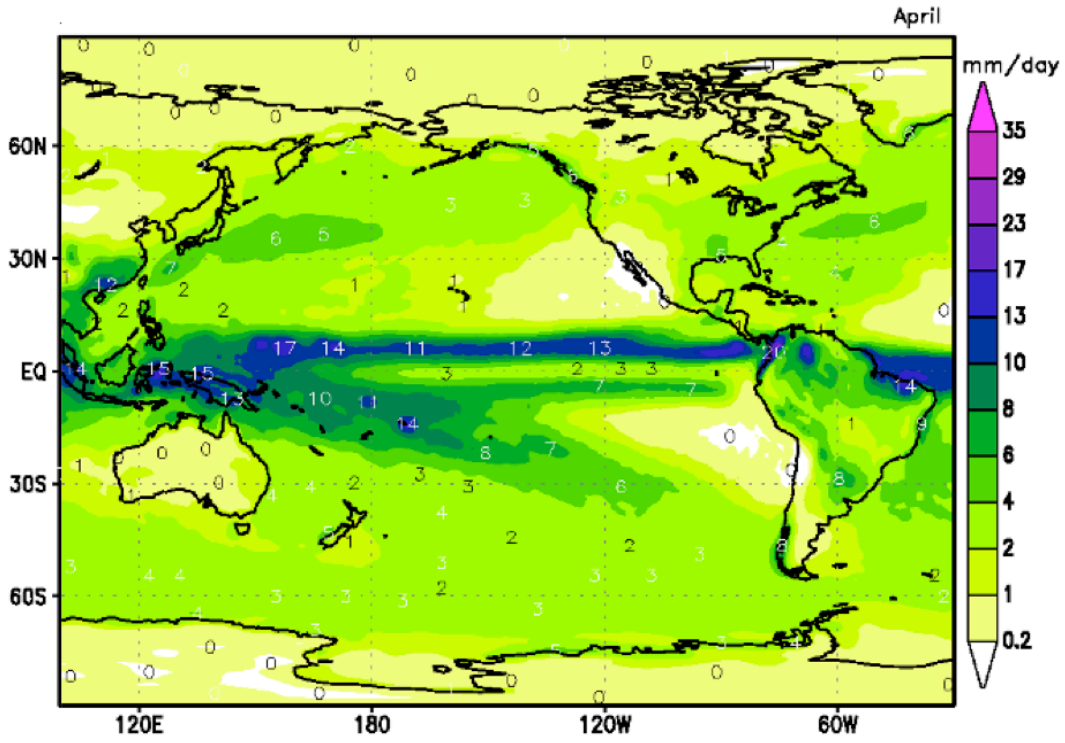

Figure 2: Monthly average precipitation over the Pacific region in April, according to the Japanese Reanalysis (http://ds.data.jma.go.jp/gmd/jra/atlas/eng/atlas-tope.htm). Under normal conditions in April the southern ITCZ is weaker than the northern ITCZ.

The prospect of weakening trade winds over the Eastern Pacific Ocean threatened the feasibility of the plan to cross the Pacific ocean with their 47-foot long ship, called *Luna Azul*. Nevertheless, after filling the tanks of *Luna Azul* with 600 litres of fuel and 600 litres of water, and bringing food on board for at least 6 weeks, Bert and Marion left the capital of Baja California, La Paz, for a journey of more than 5000 km to French Polynesia. Except for a short landing on the Mexican Revillagigedo Islands, about 400 km from La Paz, this journey would be "non-stop".

On 15 March 2014, six days after leaving La Paz, *Luna Azul* reached the first Revillagigedo island of San Benedicto. The journey was uneasy, with episodes with too little wind and episodes with too much wind. After a short visit to the coast of the Island of Socorro (they were not allowed on land), the non-stop journey started on March 26. Bert wanted to set sail to Clipperton, which is a deserted coral atoll located at 10°N and 109°W, but as their appointed advisor on meteorological affairs, I wrote Bert that this track would bring them into a region with very variable and possibly very weak winds. Moreover, the eastern Pacific *double* Inter-Tropical Convergence Zone (ITCZ), consisting of two precipitation zones, lying parallel to the equator, one at about 5°S and the other at about 8°N (figure 2), at that time seemed rather more menacing at this longitude (109°W) than further west, at 130°W. Bert quickly decided to follow my advice, i.e. to avoid this route and go further westward, taking advantage of the stronger trade winds at higher subtropical latitudes. At first, these winds were weak and accompanied by clear skies, but high waves suggested stronger winds further ahead. This indeed was the case.

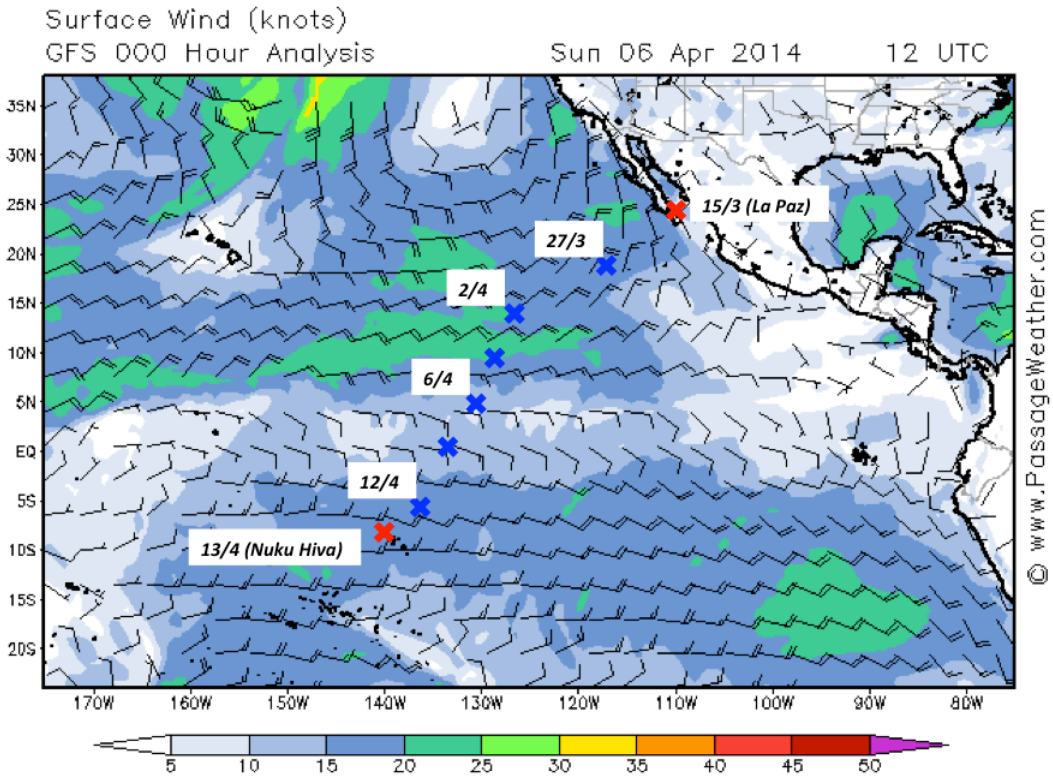

Figure 3. Track of the trip of *Luna Azul* from La Paz to Nuku Hiva, superposed on the analysis of winds for April 6, 2014. Near surface wind speeds are indicated by colours in knots. Selected positions (crosses) with dates (day/month) are indicated.

On April 3 Bert reported that their position was 10°N, 128°W and that high waves were making it very uncomfortable on board. Moreover, due to New Moon the nights were absolutely dark. Each morning Bert and Marion had to shove piles of jelly fish and a certain type of "flying fish" from the deck back into the ocean, while not understanding why these creatures would want to come on board.

Panic came over Bert and Marion when it appeared that the automatic pilot was not working. The prospect of having to manually steer the boat through the rough seas was not attractive, to say the least. Fortunately, after calling the specialist on land via the satellite telephone, it turned out that the spare parts, which were needed to repair the automatic pilot, were on board.

The atmosphere was getting very moist, which indicated that they were approaching the northern ITCZ. On April 4, at 8°N and 129°W, *Luna Azul* indeed entered the northern ITCZ, with notably calmer conditions and beautiful and impressive cumulus cloud formations, resembling big floating castles in the air. Conditions seemed to turn out better than expected. However, on April 8, at a distance less than 200 km north of the equator, the first big thunderstorms appeared, accompanied by very variable winds in both direction and strength. For the first time the sails were let down. Later that day the first signs of the meteorology of the southern hemisphere became apparent: the wind veered from predominantly northeasterly to south-easterly.

On April 10 *Luna Azul* crossed the equator. Unexpectedly, the winds again were blowing from the north-east. Skies were grey and rain was falling almost without interruption. Progression was very slow and uncomfortable. On April 12, at 5°S and 137°W, *Luna Azul* reached the ITCZ of the southern hemisphere. This ITCZ was characterized by both clear skies and clusters of intense rain showers, accompanied by wind gusts, thunder, lightning and high waves.

After enduring the second ITCZ, the steady south-east trade winds of the Southern hemisphere rendered the last relatively short leg of their trip to French Polynesia a lot more comfortable. On the last day Bert and Marion were so eager to reach their destination that they turned on the engine. In the afternoon of April 13 *Luna Azul* safely reached its goal: the island of Nuku Hiva, the biggest of the Marquesas Islands, at 9°S and 140°W. Finally, Bert and Marion could buy fresh bread! You may read more stories of this heroic trip and view images of these beautiful islands on the following website: http://www.wearesailing.nl/.

Figure 4. Welcome to French Polynesia!

Figure 5. Bert comes aboard with fresh French Polynesian baguettes.