UNIVERSIDAD NACIONAL DE INGENIERÍA

CLEVER

Linearization of air temperatures on the Pacific Ocean on the Equatorial line

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ABSTRACT

The data analyzed were obtained from TAO Project of Pacific Marine Environmental Laboratory (PMEL) of National Oceanic and Atmospheric Administration (NOAA) of United States (PMEL-NOAA, 2015).

Working with meteorological and mathematical processes, we will work with Time Series (Emery, 2006) and lag correlations (Pickard, 2007) among several pair of buoys.

An important observation is that the Pacific Ocean could be treated as a pair of connected Oceans due to the different behavior between the eastern Pacific and the West side of the Ocean.

INTRODUCTION

This project deals with a study of daily data of the temperature of the atmosphere over the Pacific Ocean at 3m high, between 10º N and 10º S, see Figure 1.

We could appreciate the approach on their behavior enclose by buoys, just applying time correlation processes of each buoy respect the others, grouping them by pairs.

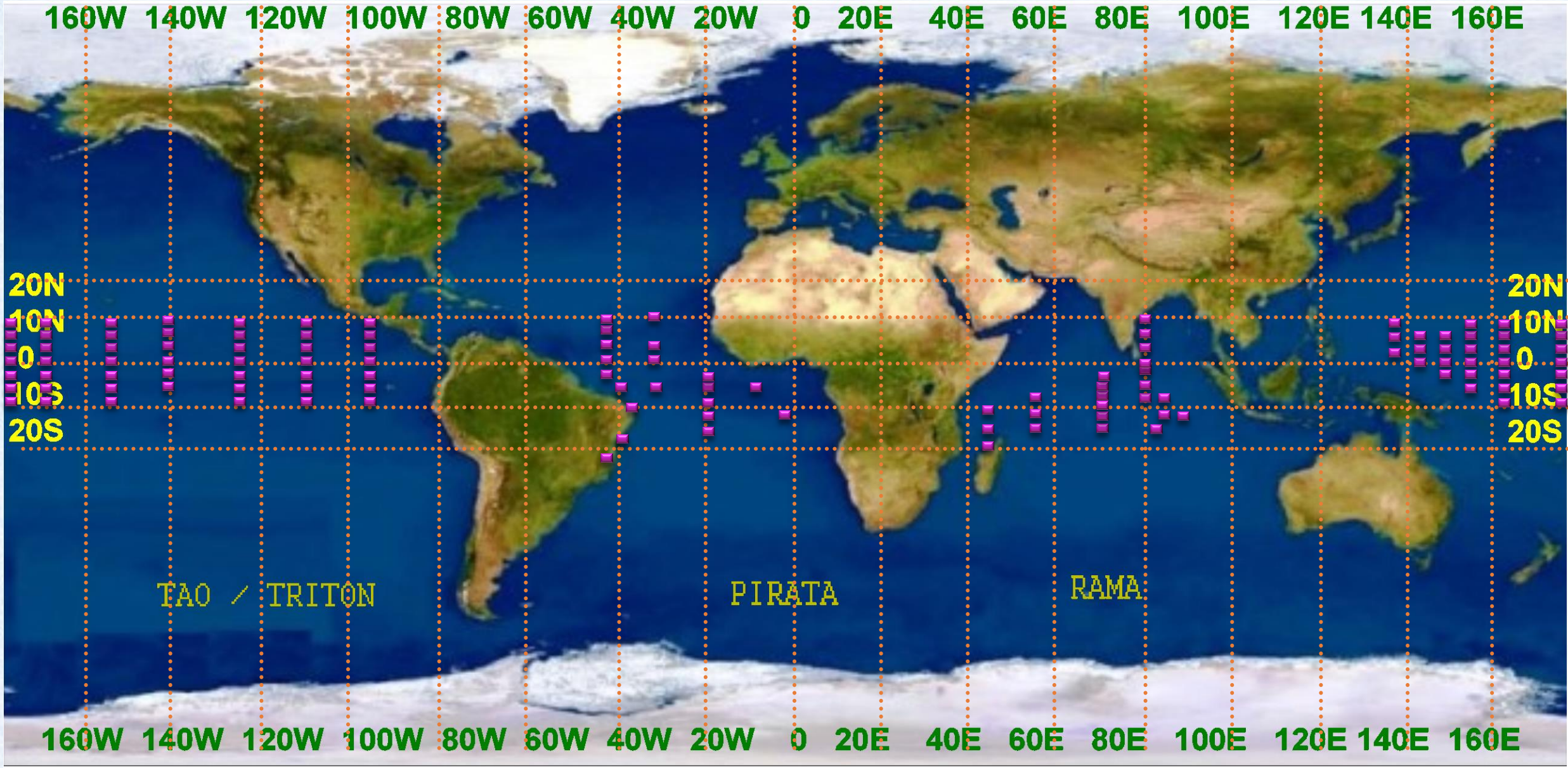

Figure 1: LOCATION OF THE BUOYS FOR TAO PROJECT.
Adapted from "Transpacific project" by http://www.transpacificproject.com/

METHODOLOGY

Calculation of lag correlation coefficients τ, could be done by means of relationship between covariance of two different positions of buoys that measure air temperature (i.e. x and y) with their respective standard deviation:

$$\tau(x,y) = \frac{\frac{1}{N-1}\sum_{i=1}^{N}(x_i-\bar{x})(y_i-\bar{y})}{\sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(x_i-\bar{x})^2}=\sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(y_i-\bar{y})^2}} \qquad \text{(Eq. 1)}$$

If the lag correlation is relatively high, we can ensure that there is an astounding linear relationship within them; if no, we might not have a linear relationship within the observed pair which may have a lofty possibility of being a complex or chaotic system.

TIME SERIES

We can distinguish a trend of air temperature on the Pacific Ocean to oscillate with a constant amplitude approximated according to the buoy, some places with a bigger amplitude than others; but no one presents anomaly fluctuations in nowhere of this part of the Pacific Ocean, as we can corroborate on Figure 2.

Figure 2: Time Series of air temperature for buoys in the east side of the Pacific Ocean.

LAG CORRELATION

The air temperature range is very small, especially on the eastern Pacific Ocean where fluctuations of air temperatures are too small, but it does not mean that they have uniform behavior, or higher values are expected in summer and lower in winter. In the eastern meridians we find the lowest values of time correlations for buoys posted on the East side with respect to any buoy located on the Pacific Ocean. Fact that ensure that behavior of the East side of the Pacific Ocean might be chaotic, even when no phenomena is happening. Figure 2 shows lag correlation for several buoys located at the Eastern Pacific Ocean respect to buoys located anywhere of this Ocean.

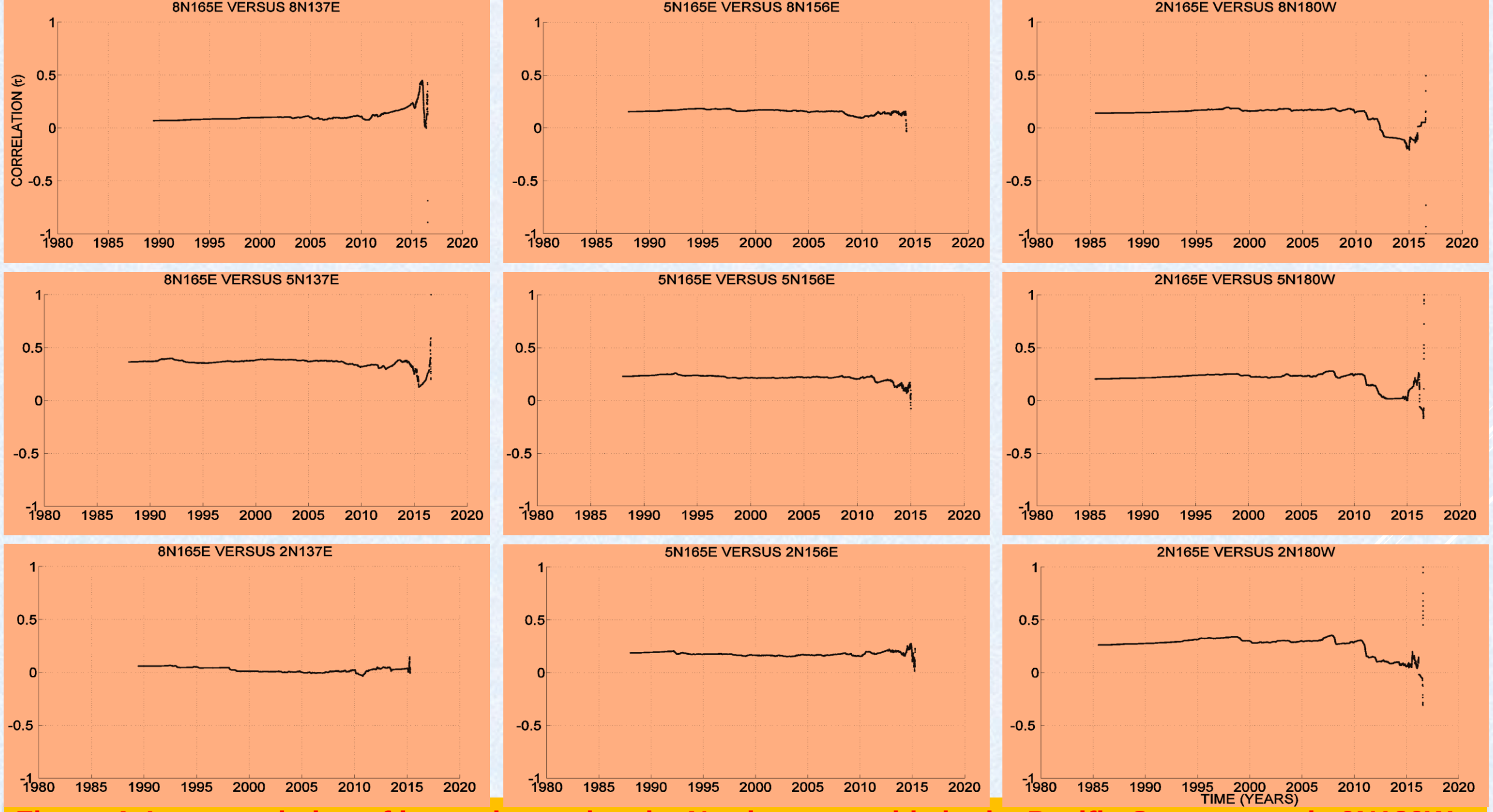

Figure 4: Lag correlation of buoys located at the Northeastern side in the Pacific Ocean regards 0N180W.

Ranges of buoys based at the east of meridian 165º E are very low, but ranges begin to increase while moving to the west, mainly with respect to their neighboring buoys and just after the year 2000.

The nonlinear system of the east part start to break, because lag correlation indexes approaching to null values of correlation for these buoys start to increase, little by little.

At the buoy occupying the 180º W meridian, we descry a considerable change in the time correlation functions, the null linearity of the eastern buoys trends to be linear regarding to western buoys.

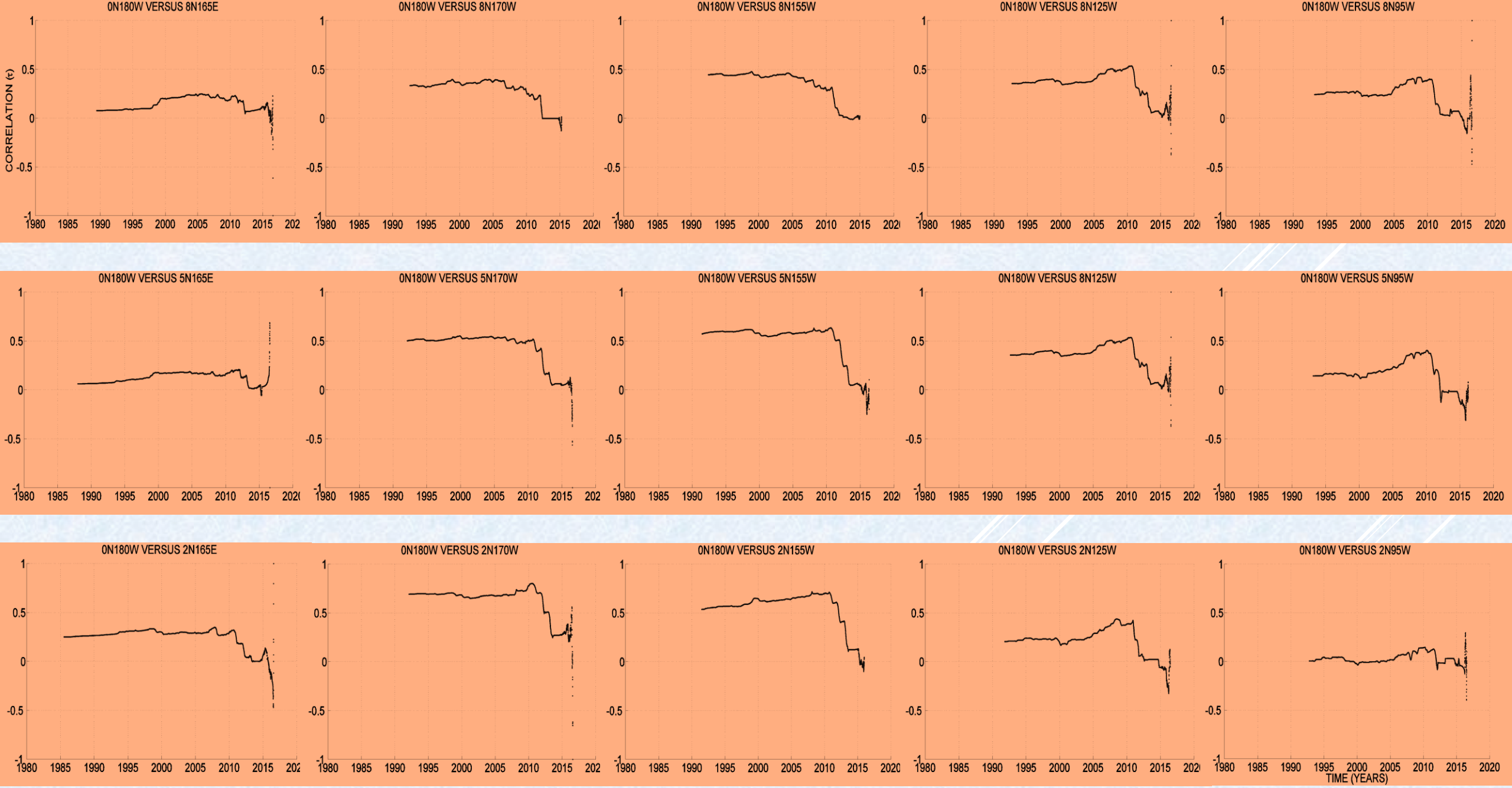

Figure 5: Lag correlation of buoys at 0N 180W from East to West.

DISCUSSION

Based on lag correlations for air temperature between all the buoys of the Tao/Triton project, even the size of the Pacific Ocean, it is possible to find a big area where linear relationship hold sway, it means, time correlations achieve values around 0.75 units.

Time correlation values of air temperatures for the western buoys maybe constant or have very small anomalies; can this fact imply that there is a constant flux of heat on their atmosphere.

CONCLUSSIONS

Clearly there is no one lag correlation for air temperatures on the eastern side of the Pacific Ocean that has high values; it involves that their there is no trend in their expected values even their ranges are very low.

Buoys located from 180W to the West side have lag correlations that go from small values to very high values, which means that there is a high tendency to have a linear relationship between buoys stationed on the Western side.

According to lag correlations analyzed in this paper, the idea that the Pacific Ocean could be seen at least as two oceans into a big one (Díez, 2016) is maintained. One on the East Pacific Ocean and the other on the West Pacific Ocean.

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THANKS

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