

Carbon Flux and Footprint in the Arid Region Of Baja California Sur

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Introduction

Global Change Research Group (GCRG), directed by Walter C. Oechel Ph.D., is researching how elevated CO₂ in the atmosphere is impacting ecosystems around the world.

CO₂ levels in the atmosphere have been shown to be increasing dramatically since the burning of fossil fuels. As a greenhouse gas, this elevation is being shown to have consequential effects on climate, and ultimately affect all organisms in different ways by means such as the sea level rising and more severe weather patterns that can wipe out populations and sources of food.

It is also a political concern. As global temperature rises, agricultural areas may become unsustainable, resulting in dependence upon other countries or mass migration, which in turn may result in more wars over land and borders. The changes in climate are too rapid for evolutionary adaptation and thus poses a major threat to life on this planet.



Dr. Oechel is also a professor of Biology at SDSU, Coordinator for the Joint Doctoral Program in Ecology with the University of California Davis, and Academic Director of the Field Stations Program.

Method

I'm working with two grad students from SDSU, Tom Bell and Yareli Sanchez, who are conducting research in the arid region of La Paz, Baja California Sur, Mexico.

A major method of data collection is the Eddy Covariance system (Figure 1 and 2). This system basically reads vertical wind flux to estimate the instantaneous covariance of wind direction and speed with CO₂. More instruments on the system take into account other variables such as the amount of sunlight, temperature and humidity.



Fig. 1 This is the Eddy Covariance Tower in La Paz. It sits on designated research land belonging to the Centro de Investigaciones Biológicas (CiB). It monitors turbulent flux to correlate CO₂ movement in and out of the ecosystem.



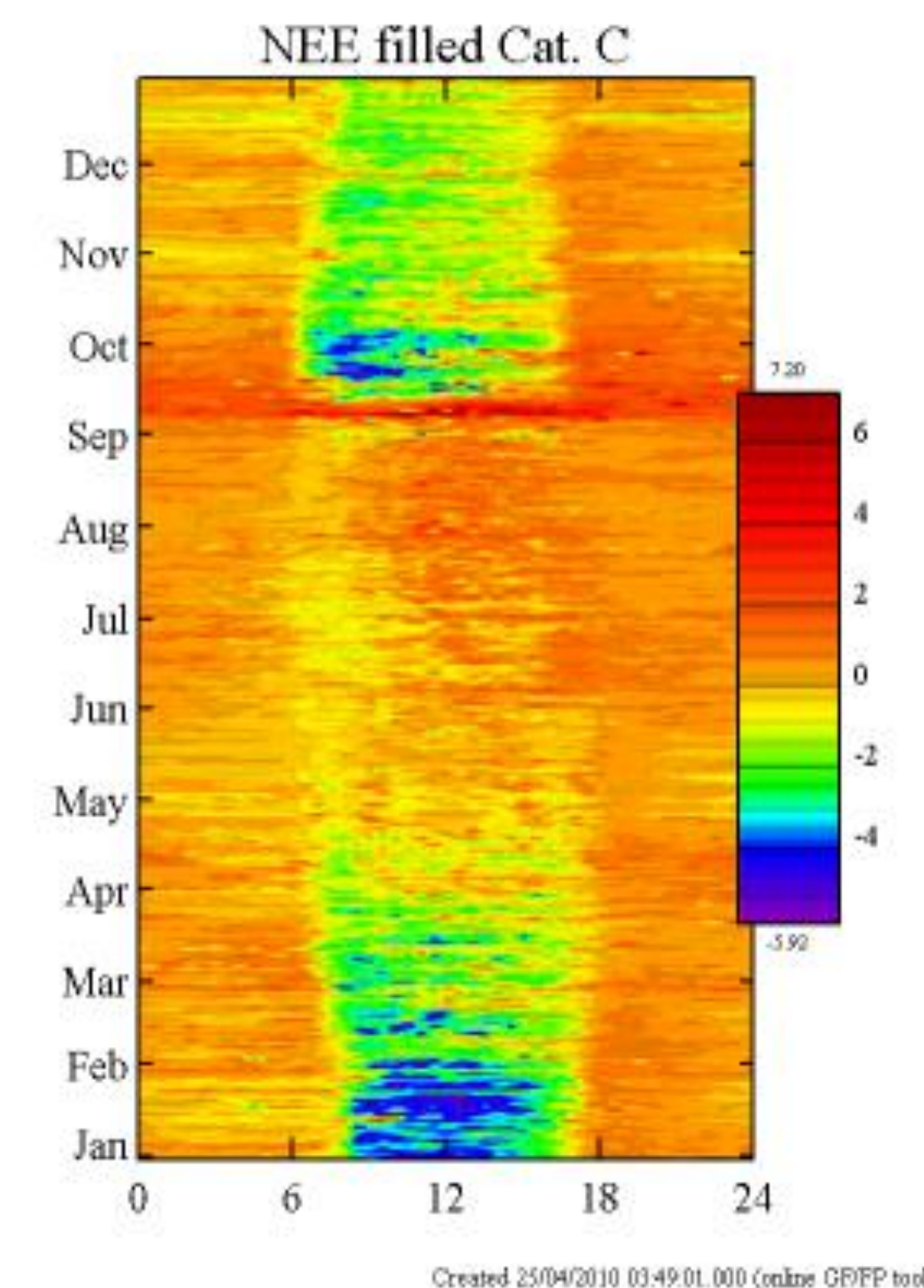
Fig. 2 This is the top of the Eddy Covariance system, which sits the Infrared Gas Analyser (IRGA) that detects CO₂ and H₂O gas, and a Sonic Anemometer to record vertical turbulent flux.

My internship involved methods for several projects, such as collecting leaf litter from random plots in designated areas to estimate carbon movement in and out of the area. Other work was constructing litter traps, maintenance of the plots, creating transects through a mangrove and installing traps and equipment for measuring soil respiration, and other activities such as sorting the litter and weighing them (cacti and scorpions make all this more exciting!). We had to crawl our way through dense, muddy mangroves to install the equipment! And during testing we camped at the site to get continuous data.

Results

Mr. Bell has two projects here in La Paz that I am helping with. One is the collection of data of the carbon footprint in the area, by means of his plots and litter traps. August will be the end of this project, at which time he will be able to analyze the data fully. Until such time, he cannot make any conclusions. Ms. Sanchez is just beginning her research in the mangroves off Magdalena Bay, which involves a similar method of data collection to study litter fall. Yareli is also looking at soil respiration over a 24-hour periods. We have started performing the tests on soil respiration, however many more collections will be necessary to make an analysis.

The tower was installed in 2001 and was analyzed by Steve Hastings until 2003. Mr. Bell took over in 2008, as his initial project here, and is analyzing data from the Eddy Covariance for the years of 2004-2008. I was able to learn how the data is reported and how Tom is going about analyzing the data. The system isn't perfect, so he has to make up for data inaccuracies using a new system of algorithms that I was introduced to. Plenty of time goes into making sure the data can be properly analyzed, which is what he is currently doing. Below is a graph based on information from the Eddy Covariance that Mr. Bell has explained to me.



This is a graph of the Net Ecosystem Exchange (NEE) from the Eddy Covariance of data from 2002. The graph shows the 24-hour period of each day condensed to show changes over the course of the year. Lighter colors of blue and green represent a net sink in carbon, by means of photosynthesis outperforming respiration. The dark colors above zero represent respiration outperforming photosynthesis, meaning that these periods mark the ecosystem as a source (it is producing more carbon than it is taking in).



Mr. Bell in the middle, myself on the left, and 3 friends that work at CiB

Conclusion

Because of natural patterns in climate over large time scales due to the earth's rotation, analysing data over a much larger time period would be more conclusive. Though knowing these patterns, one can still make predictions.

From my experience here in La Paz I have come away with valuable knowledge about conducting and analysing research. I've learned several methods of ecological research and more about ecology in general. Living in a different part of the world has been a great experience in its own that has expanded my insight in a broad sense.

Acknowledgements

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I want to sincerely thank Dr. Nouna Bakhiet for giving me this opportunity all that she has done for me.



Left to right: Steve, Mr. Bell, Steve, Miguel, Ms. Sanchez