Masters Project Report

linc2908

March 21, 2014

Abstract

This will be a lovely abstract. Text currently here to ensure that the layout is correct.

1 Introduction

- broad aim of project
  - Construct a simple model of CO2 flux in the equatorial Pacific
  - Focus on Carbon flux during ENSO
- Description of ENSO
  - Definition El Nino
  - Definition El Nina
  - Definition ENSO
  - describe thermocline
  - describe ocean atmosphere coupling
  - diagram of coupling
  - idea that ENSO is due to perturbations in the thermocline depth
  - describe Kelvin and Rossby waves
- why is this project important?
  - ocean is a huge store of CO2
  - important to understand ocean atmosphere transfer in order to forcast atmospheric CO2 levels
  - This region is especially important as the GCMs struggle to accurately represent ENSO
- detailed goals of project
  - model should be physically intuitive
  - model should be as simple as possible both conceptually and computationally

2 Experimental Method

- basic outline of model
  - split flux into two main components
  - expect the temperature of the water at the surface to effect the amount of carbon that can be dissolved within it, and so crfeate a flux
  - expect that the cold, carbon rich water being upwelled will release carbon as it warms up in the upper layer
  - note what we have ignored
    - biology
    - horizontal currents
  - approximation that these are independant
- contribution due to sst..... explanation + equations
  - We expect changes in the temperature of the water to effect both the solubility of the water and the partial pressure of the CO2 dissoled in it
  - present equation for flux from sst
  - graph of solubility of CO2 in water
  - approximate the solubility of CO2 in sea water as *eqn* in this temperature range
  - approximate pCO2 ocean as *eqn*
  - talk about the gas transfer constant
  - rewrite full equation
- contribution due to upwelling ..... explanation + equations
  - cold upwelled water is carbon rich
  - as it warms we expect an amount of carbon to be released
  - equation
- summary of full model
  - *eqn*
- test on globe???
  - redo these graphs and see if they are interesting
  - global plot for flux due to sst
  - compare with data
  - global plot for flux due to upwelling
  - compare with data
- one to get this in terms of just 1 parameter
  - wish to see how the carbon flux is effected by ENSO
  - need a model based only on some ENSO strength parameter
  - will choose thermocline height

  - from data, 20 degree isotherm height will act as a standin
  - we hope that all variables can be characterised in terms of this
- look for correlations in data
  - analysis of data to obtain anomaly data
  - look for correlations between isotherm anomaly and other variables
  - plots go here???
- model for upwelling
  - there is no recorded data for the upwelling velocity
  - we must construct a model from the variables availiable
  - assumption that heat should be the same everywhere
  - we calculate a volume of cold water from the difference
  - we create an replenishment rate R
  - we use this to calculate an aproximate upwelling rate
- comparison with data to obtain constants
  - fetch data for true carbon flux
  - fix parameters such that the mean values agree
- final summary of the model
  - putting everything together
  - *eqn*
- model of thermocline height
  - to test the dynamics, we need a simple model of thermocline height
  - outline the simple delay model
  - descibe chosen forcing
  - show iterative solution for h
  - this h can now be used as the variable for the flux model

3 Results

- plot of carbon flux over time at one grid point real data
  - time series - 3 lines, sst, upwelling, total
  - phase space diagram
  - power spectrum
- plot of carbon flux over time at one grid point model h data
  - time series - 3 lines, sst, upwelling, total
  - phase space diagram
  - power spectrum
- time averaged carbon flux over the basin
  - sst flux
  - upwelling flux
  - total
  - real data plot

4 Analysis

5 Conclusions

6 Bibliography