Topics to be Covered

Nonlinear Systems
Chaos
Fractals
Chaos, Strange Attractors, and Weather
Chaos and Climate
What is Climate?
Temperature
What is Climate Change?
A coordinate system for the Earth
Why you should believe the scientists
Looking at the Data
Is the Climate Changing? Details….
Recent Evidence
Climate over the Earth's history
Paleoproxies
The Earth's long-term climate record
Radiation and Energy Balance - Begin effort to understand……
Temperature and energy
Electromagnetic radiation
Blackbody radiation
Energy Balance
A Simple Climate Model
The source of energy for our climate system
Energy loss to space
The greenhouse effect
One-layer model
Two-layer model
n-layer model
Visualizing these ideas
The Carbon Cycle
Greenhouse gases and our atmospheres composition
Atmosphere-land biosphere exchange
Visualizing the Main Components of the Natural Carbon Cycle
Atmosphere-ocean carbon exchange
The combined atmosphere-land biosphere-ocean system
Atmosphere-rock exchange
How are humans perturbing the carbon cycle?
The long-term fate of carbon dioxide
Forcing, Feedbacks and Climate Sensitivity
Time lags in the climate system
Radiative forcing
Putting it all together
Predictions of future climate change
Predictions of future radiative forcing
Predictions of future climate Over the next century
Climate change beyond 2100
Is the climate predictable?
Physical Impacts

Abrupt climate changes
Exponential Growth
Putting it together: The social cost of carbon
Special Topic #1: Tying celestial mechanics to Earth's ice ages
Special Topic #2: Details on Climate Modeling
Modelling the climate system on a Computer
Types of models
Components of a climate model
Numerical resolution of the equations
Time and space discretizations using finite differences
Testing the validity of models
Special Topic #3: Simulation of Global Climate Change 1870-2100 NCAR
Latest Data