This report will provide a summary of the process, begun in late 2006, to rewrite Florida’s Sunshine State Science Standards (SSSS), with a focus on the weather and climate elements. This report summarizes the contributions of over 60 Framers and Writers and the dedicated staff of the Florida Department of Education’s Office of Mathematics and Science. It will also serve to update stakeholders on the newly completed Climate Literacy Framework Document, and evolving Atmospheric Science Literacy Framework Document, both of which can help to inform this issue.
Outline

- Action - 10 years after initial standards were developed, Framers and DOE Staff (Office of Mathematics and Science) charge Writers to develop new standards
- Several meetings are used to review successful benchmarks and standards, and develop a new approach for Florida
- Public review and testimony
- Approval of final draft* standards by Board of Education
- Legislative Approval in Florida
- Related Action in Other States
- A Call for Involvement
- Public Climate Literacy - New Frameworks from National Groups
In their 2005 The State of State Science Standards Report, the Fordham Institute awarded an “F” grade to Florida’s Science Standards. Massachusetts got an “A”.

**FLORIDA**

| A. Expectations, Purpose, Audience | 6.0 | 12 |
| B. Organization                     | 6.0 | 9  |
| C. Science Content and Approach     | 11.3| 27 |
| D. Quality                          | 1.8 | 9  |
| E. Seriousness                      | 5.8 | 6  |
| Inquiry                             | 2   | 3  |
| Evolution                           | 0   | 3  |
| Raw Score                           | 32.9| 69 |
| Final Percentage Score              | 48  | 100|
| GRADE                               | F   |    |

*Reviewed: Sunshine State Standards, Grade Level Expectations: Science (1999)*

**MASSACHUSETTS**

| A. Expectations, Purpose, Audience | 10.8| 12 |
| B. Organization                    | 9.0 | 9  |
| C. Science Content and Approach    | 24.3| 27 |
| D. Quality                         | 8.6 | 9  |
| E. Seriousness                     | 6.0 | 6  |
| Inquiry                            | 3   | 3  |
| Evolution                          | 3   | 3  |
| Raw Score                          | 54.7| 69 |
| Final Percentage Score             | 94  | 100|
| GRADE                              | A   |    |

*Reviewed: Massachusetts Science and Technology/Engineering Curriculum Framework (May 2001)*

*NB: Massachusetts is currently updating its high school assessment framework.*
Framer’s Recommendations

- Refer to the 2009 National Assessment of Educational Progress (NAEP) Science Curriculum Framework to begin building 9-12 Bodies of Knowledge (BOK) based upon science literacy expectations for all graduating seniors.
- Construct grade level specific benchmarks for K-8 that support the 9-12 Bodies of Knowledge.
- Refer to the General Topic Trace Mappings for the TIMSS A+ countries to analyze standards for coherence once they are completed.
- Refer to the Massachusetts Science Curriculum Framework to see how illustrative examples can be included with each content statement to add clarity.
- Refer to AAAS and National Research Council (NRC) literature to imbed Nature of Science (NOS) concepts within the standards as well as NRC materials on teaching evolution and the nature of science.
- Construct a Nature of Science Body of Knowledge for 9-12 and embed these concepts in the K-12 benchmarks.
Big Ideas in Science
Moving the K-12 Standards Forward

- **Earth/Space Science Subject Area**
  - Earth in Space in Time
  - Earth Structures
  - Earth Systems and Patterns

- **Topical Areas of Concentration (Earth Sciences and Overlapping Life/Physical Sciences) - Florida Focus**
  - Plate Tectonics
  - Oceans
  - Weather and Climate
  - Evolutionary aspects (!!!)

- The areas of Evolution and Climate Change evoked the most controversy, along with any discussion of theories of origin of anything
  - Anti-evolutionary groups nearly derailed the entire process in Florida
  - Then they nearly allowed for unreasonable constraints on teaching bordering on unconstitutional protections
  - In the end, reason prevailed (this year)...in Florida
Legislation Continues to Move

• Framers chosen winter 2006/7, 1st meeting Spring 2007
• Our process continued for nearly one year and resulted in final standards approved by the Florida Board of Education in Feb. 2008
• Legislature could not agree on language to change our work, in spite of efforts of a small number of “external forces”, including the Discovery Institute, national evangelical organizations, and Ben Stein
• 2008-2009 - Courses and Curriculum Changes
• 2009-2010 - FCAT Science Revisions
• Louisiana - “Academic Freedom Act” for K-12 is moving forward (passed unanimously in the House) - to immunize teachers who wish to bring in alternative views to established theories in the areas of
  - Biological and chemical evolution
  - Human cloning
  - Climate Change
  - Michigan has two different bills with the same purpose
• These bills are unnecessary, as the new standards reform movement incorporates the Nature of Science as a process of inquiry, discovery, and the recognition that science is not static!
<table>
<thead>
<tr>
<th>Benchmark #</th>
<th>Descriptor</th>
<th>Big Idea</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC.912.E.7.1</td>
<td>Analyze the movement of matter and energy through the different biogeochemical cycles, including water and carbon.</td>
<td>Earth Systems and Patterns</td>
</tr>
<tr>
<td>SC.912.E.7.3</td>
<td>Differentiate and describe the various interactions among Earth systems, including: atmosphere, hydrosphere, cryosphere, geosphere, and biosphere.</td>
<td>Earth Systems and Patterns</td>
</tr>
<tr>
<td>SC.912.E.7.4</td>
<td>Summarize the conditions that contribute to the climate of a geographic area, including the relationships to lakes and oceans.</td>
<td>Earth Systems and Patterns</td>
</tr>
<tr>
<td>SC.912.E.7.5</td>
<td>Predict future weather conditions based on present observations and conceptual models and recognize limitations and uncertainties of such predictions.</td>
<td>Earth Systems and Patterns</td>
</tr>
<tr>
<td>SC.912.E.7.7</td>
<td>Identify, analyze, and relate the internal (Earth system) and external (astronomical) conditions that contribute to global climate change.</td>
<td>Earth Systems and Patterns</td>
</tr>
</tbody>
</table>

See handout for complete examples of explicit weather & climate language in the new standards
On the relevance of science in public education...

- GLOBE is one example of a program that integrates scientific inquiry (by students) with scientists’ views of science
- Politics, science education, and science meet (Sandy MacDonald, Al Gore, George W. Bush, Edward Kennedy)
- Direct in situ observations, remote sensing, use of proxy data, use of models (conceptual, numerical, statistical, etc.)
- Scientists and educators need to get involved in statewide efforts to improve geoscience teaching, and combat limitations on “controversial issues”
On the Maturation of Climate Literacy

- This document is out now (Spring 2008)
- Part of the Earth Science Literacy Initiative efforts (NSF, UCAR, AAAS Project 2061, Federal Agencies, Universities, Private Sector, NGO)
- [http://www.earthscienceliteracy.org/](http://www.earthscienceliteracy.org/)
- Succint
- Documents will guide federal agencies in terms of research priorities, inform national and state science educational standards, and provide practical applications of science in all areas of the geosciences
  - Oceans (done)
  - Climate (just completed)
  - Atmosphere Science (in 3rd review)
  - Hydrology (just beginning)
K-12 & Informal Science Education
Goals Should Resonate

• A reasonable expectation for a climate literate society would be one that provides for a basic understanding at the K-12 level
  - Use existing frameworks for high school level as a starting point for expectations for the general public
• A college class should raise the bar and increase understanding by fleshing out some of the more difficult aspects
  - But should not presume that all expectations at high school level were met
  - Teacher preparation for climate/atmospheric science literacy is quite low - earth/space science has the greatest percentage of teachers who are not qualified according to a recent study
• It seems reasonable to start with the Climate Literacy document as a starting point - let’s review it
  - 7 major threads

Photo credits: Climate Literacy
What is Climate Literacy?

- A climate-literate person
  - Understands the essential principles of all aspects of the Earth system governing climate patterns that are presented in this document
  - Knows how to gather information about climate and weather and how to distinguish credible from non-credible scientific sources on the subject
  - Communicates about climate and climate change in a meaningful way
  - And makes scientifically informed and responsible decisions regarding climate
Essential Frameworks of Climate Literacy

1. Life on Earth has been shaped by, depends on, and affects climate
2. We increase our understanding of the climate system through observation and modeling
3. The sun is the primary source of energy for the climate system
4. Earth's weather and climate system are the result of complex interactions
5. Earth's weather and climate vary over time and space
6. Evidence indicates human activities are impacting the climate system
7. Earth's climate system is influenced by complex human decisions involving economic costs and social values
Climate Science at the College & University

- **Climate Science for Non-majors**
  - Course is usually taught by meteorology or geography faculty, but more often is taught by other physical science faculty (at schools with no major in the field)
  - May meet college liberal studies objectives

- **Climate science for the major**
  - A course in physical climatology is now required by the Federal government to attain employment as a meteorologist (GS 1340 criteria)
  - Such a course probably does an adequate job defining climate and climate processes, but does not adequately cover all the key frameworks in the Climate Literacy document

- There is motivation for a new approach: Climate science for the college graduate
Climate Science for the College Graduate

- At FSU this process is motivated in large part by a new grant from the U·Teach organization at University of Texas to develop a large cadre of highly-qualified new teachers in SMET critical areas (math/science):
  - Biology
  - Physics
  - Geosciences
  - Chemistry
  - Mathematics
- 12 Universities were selected in 2007 to participate, including UF
- Support is provided by State of Florida (matching) in funds provided to U·Teach by Exxon/Mobil and the Helios Foundation
Our Target Population

• UT seeks to replicate their successful program which attracts top students to their U•Teach majors - these new teachers have higher retention rates within the K-12 system

• Initial Targets - science education majors within U•Teach but also new major in Meteorology: Applied Geosciences-FSU Teach

• Other fields of interest
  - Business
  - Geography
  - Geology/Water Resources
  - Agriculture
  - Insurance/Risk Management
  - Public Policy
  - Environmental Engineering
  - Journalism
What should such a course contain?

1. Life on Earth has been shaped by, depends on, and affects climate
2. We increase our understanding of the climate system through observation and modeling
3. The sun is the primary source of energy for the climate system
4. Earth’s weather and climate system are the result of complex interactions
5. Earth’s weather and climate vary over time and space
6. Evidence indicates human activities are impacting the climate system
7. Earth’s climate system is influenced by complex human decisions involving economic costs and social values

Let’s get some answers together!