Session Goals

- Discuss options for computing activities for summer workshop,
- Identify the best fit(s) for ESIP Education,
- Plan the workshop session for the 2018 ESIP Summer Meeting.
Draft Project Goal:

To promote the use of Earth Science data through coding

- not creating a computer programmer
- logical thinking skills with fun
- Excited students to go on to do more
- To gain familiarity and comfort at looking at what’s under the hood
- To be able to …
- To appreciate that coding allows scientists to analyze data… data is integral to coding… understanding what data looks like
Coding Complexity/Abstractedness Spectrum

- Applications
- HTML
- Macros
- Javascript
- WYSIWYG
- Visual / Block coding
- 'Pure' Coding

**Example Dreamweaver**

No if/then etc logic

Coding within an application (spreadsheet / ImageJ)
Allows logic

Complex logic
Storymaps as a coding platform

- Using as a coding tool
- Where to find data
  - Map servers at NOAA - reads in netCDF
  - Data.gov
  - mynasadata.gov - great for getting ideas for projects
- Premaking the map products - writing a script to derive - too advanced? to write
What is coding?

• Language that codifies commands, example: Goto; for - next; if - then;
• Lines of code: each line is a ‘command’ - a sequence, not necessarily linear
• Logic: Decision making based on input
• Abstraction… as a key concept of programming
• Ability to manipulate and change
• Using a programming language
• Hidden Figures. The transition from computers as people to computers as they are now.
• What does the computer know? eg, the vocabulary list of the language
• Not coding - an application that helps you do something, has its own language, however there’s no sequencing or logic
• Its a sequence - process through the code -
Behaviors of Good Coders

• Coding in pairs: switch roles to do coding and do QC
• Analyzing programs: debugging, predicting the behavior of someone else's code, and thinking about efficiency.
• Coding can be social and interactive and rely on stuff folks have done before.
Code activity & workshop org ideas

Looking for premade coding examples that could be reused
Earth Science Interactives that could be coded (using libraries of code for complex sections)
Coding Activity ideas

- Tie in the movie, Hidden Figures. The transition from computers as people to computers as they are now.
- Using cards with instructions to create a program
  - Move from one location to another using basic walk, turn, stop commands
- Create a simple science model using code: coalescing water sprites, for instance.
- Some EET chapters have coding within them
- Some folks prefer going right into a programming language.
- Block languages help young kids get into it faster. Enables early success.
- Kids write a program to make a physical object move
- Equations in a spreadsheet - Macros in a spreadsheet with variables changing
  - What portion of Earth’s water is fresh and accessible?
  - Decades of ice-off dates in Madison.
- Show an example of a simple GitHub?
- Code a simple app for iphone / html5?
Coding Activity Ideas

- **StoryMap / Image J**
  - Show a final storyboard … then show edit page … then dig in to find maps (urls that in /mapserver)
  - Build/extend a storymap - making a choice for the teachers
  - Play time – to explore and experiment (give 3 choices of what to explore)
  - it can be extended.
  - Make their own macros
  - Here are things that others have created - that social component / GitHub

- **ESRI GeoInquiries** are paired sets of prepared AGOL maps and PDFs of instructions. One possibility for a bounded workshop activity would be to use this existing content and turn one or more of them into Story Maps.

- Showing a list of projects on GitHub (pointing specifically to ones that have been forked from other sources) also seems like a valuable thing.
Education Workshop Organization Ideas

• Start w/ block activity (that can show the language); move to similar activity with language; macro activity;

• Consider organizing based on teacher comfort vs how it might be taught in the classroom
  – Start with Excel / spreadsheets … then macros … then block … then …
  – the plethora of versions of Excel is a real problem – can Google Sheets be a solution?

• HTML5 runs in every browser (Flash is going away)

• Storymaps – can be both an application and coding environment (ex?)

• WYSIWYG … Macro … simple coding environment
  – See the real tool, then see ‘under the hood’ … it’s just a language
**Example programming languages**

- Macros in ImageJ
- Excel macros / functions
- html
- Intro languages: Hello Processing
- Block languages
  - Scratch (Flash based?)
  - SNAP,
  - Tynker (Swift)
  - Block Py
  - NetLogo(?), Turtleworks (still supported?)

**What are the most common languages used in ESIP community?**

- Working environment languages
  - Python
  - C++
  - Javascript
- MatLab
- Modeling programs
Educational Perspective

- Educational learning theory along with how we teach coding
- Learning is socially constructed / mediated
  - Gaming - minecraft
  - Constructivist approach is still there too
Discussion about coding & summer session
[input from session, page 1 ]

What is coding to you?
- everything on a computer is coding
- scratch - might be a hurdle to move from visual representation of coding - lines of text

What are we doing ‘coding’ for?
- Creativity and critical thinking? or to create programmers?
- Manipulating data and getting it into a format that I can use
- Kalo: coding is being creative to solve a problem.. creating something or changing it for what you want it to do
- Command line / script line coding
- Good bridge between object and text coding is Jupyter notebooks - Add something to an editor and compile: constant feedback is very useful

What can we do during the summer workshop?
- Get educators to learn coding AND? accomplish something Earth Science related?
- Regardless of which platform you choose, it will take 4 hours and be a major accomplishment.
- What about NEO? Ten easy step to analysis? ← An example of a very simple earth science problem. Not a good coding example. Tool is all wrapped up.
- Excel: copy temp data from a website and generate a graph.
- Use a macro to make this happen repeatedly?
- Google Sheet.
- Start from Scratch? Macros in Image J? Story Map? Experiments with creativity?
- Convert something coded in Flash to another format?
- ERDDAP - tool for the ocean community. Query capability to customize map or export in a certain format.
### Discussion about coding & summer session

#### What can we do during the summer workshop? (cont)

- A bridge: you give them just enough to get interested and then encourage them to participate in a community conversation. Could be an educational tool.
- NCAR: ContainerWrf Docker
- Start with a few terminal commands. Spits out imagery. Visualizations from Hurricane Sandy
- If you have MS, HS, and college, may need some modification.
- You feed it some lines, and it generates a visualization. Available on GitHub
- ^ terminal commands alone can amaze someone.
- Jupyter notebooks can be hosted online for a course. A strategy would be to develop a template Jupyter notebook, in which they add their own code in sections.
- Ideas from Ryan Bowe: LIDAR site: Make it spatial. Finding a dataset near your own community, read the metadata, plot the bounding box in a KMZ. Take metadata, parse out the bounding box, and draw it in Google Earth.

- Tools that help students do something creative: Story Maps could be an assignment for students. Not make teachers better lecturers.
- Google My Maps - low entry bar for getting folks using maps and visualizations.
- We have a lot of great tools for different skills: What about creating a couple lesson plans? Provide some scaffolding around existing resources.
- Earth Exploration Toolbook (EET): Examples of using tools to get and analyze data. Help teachers use Earth Science Data Analysis tools. Explicit step-by-step instructions. In teaching those workshops, we discovered people don’t even understand what “data” are.

**Programmers talking to classroom** - making a list of speakers who would be interested in talking about their trajectory into coding