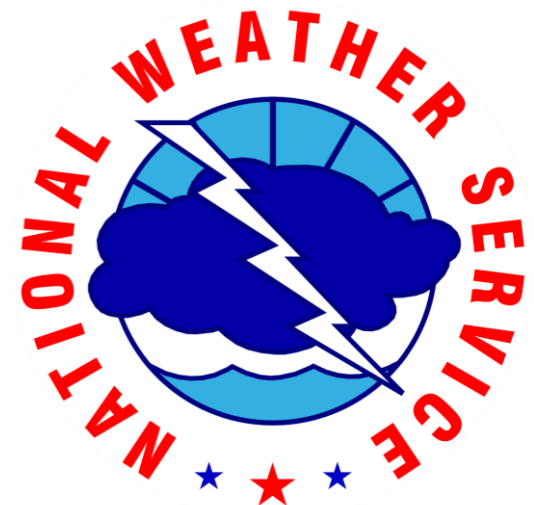
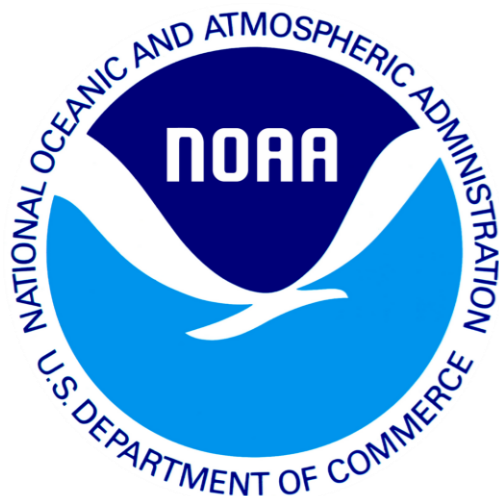


Adopting a Collaborative Software Development Process in the Scientific Community

NOAA's 32nd Climate Diagnostics and Prediction Workshop (CDPW)

Mike Charles

DOC/NOAA/NWS/NCEP/CPC



Motivation

To advocate improved software development and project management techniques, including *collaborative software development* and the use of *project management software*.

Who does this apply to?

- Universities
- Government
- Private sector
- *Any software developers*

From now on, for the sake of brevity, "collaborative work" will include use of project management software.

Disadvantages of Non- Collaborative Work

Non-Collaborative Work

A developer works alone

- Work goes unchecked by others
- If the owner leaves, nobody knows how the software works
- There are no ideas contributed by others during development

Non-Collaborative Work

A developer doesn't log changes

- Hard to revert to a previous version of the code
- Can't remember what they did last week
- Can't tell why a specific change was made

Non-Collaborative Work

A developer doesn't create documentation

- Hard for others to adopt code
- Hard for backup code owners to fix bugs and/or run code
- Hard to share code with others

Advantages of Collaborative Work

Collaborative Work

How should developers be working?

- ***Collaboration*** - Working with others leads to more ideas and creativity, and more QCing of code
- ***Tracking Changes*** - Using *revision control software*, tracking changes to code and keeping a log makes it easier to revert to older versions of the code, and keep track of work
- ***Documentation*** - Creating documentation and putting comments in code makes the code easier to understand and edit, and makes it easier to share code with others

Collaborative Work

How do we know these methods are better?

Open source software is a great model:

- Started in 1983 - GNU Project - free software
- Open source software is free to edit and distribute
- Usually developed collaboratively
- Usually contains sufficient documentation
- Meant to be shared with many others
- Linux operating system entirely based in open source
- Essentially, open source practices promote better software development

Project Management Software

Collaborative Work

Software to help with collaborative development...

- **Wiki** – A web site developed collaboratively by a community of users, allowing any user to add and edit content.
- **Revision Control** – Management of changes to documents and software, including a history of all changes made and logging for each change.
- **Issue Tracker** – Software that manages a list of issues or tasks that need to be fixed or completed.

There are open source versions of all of these.

Wiki

What is a Wiki page?

- Webpage containing text, pictures, and other information that can easily be edited by a team of people
- For example, developers can create a new wiki page for each component of a piece of software (eg. gui, database backend, etc.)
- Developers can also use wiki pages to document scripts and source code

Wiki - Trac

Can format text and images any way you want

Coding Standards

EPG

In order to keep coding practices uniform across all of the developers, we need to follow some guidelines about how to write code. A great resource for us to begin with is the set of [coding standards](#) developed by the Engineering Process Group (EPG). Please see that documentation for more information.

Naming Variables

CamelCase versus Underlines

- Variables should utilize CamelCase between words that are part of a phrase:

```
fileName = '/sandwich/banana/pickle.txt'
```

and an underscore should separate parts of the filename that are not part of a phrase:

```
fileName_sandwich = '/sandwich/banana/pickle.txt'  
fileName_salad    = '/salad/apple/mustard.txt'
```

Objects

- When creating an object, the object's name will be the class name plus *Obj*:

```
Data dataObj = new Data();
```

- When a variable is a comma-delimited String that gets split and looped over (eg. users can choose to get Heidke for several models), the comma-delimited version should get *List* appended to the name, and the version that gets looped over (after the split) should retain the original name:

```
fcstSourceList = "off, auto, klein";  
for (String fcstSource : fcstSourceList) {  
    System.out.println("Forecast source = " + fcstSource);  
}
```

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[EPG](#)

[Naming Variables](#)

[CamelCase versus Underlines](#)

[Objects](#)

[Array Versions](#)

[Commenting](#)

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[Commenting small tasks](#)

[Major code sections](#)

[Naming Java Packages](#)

[Variables used to pass information to another class/method](#)

[Throwing Exceptions](#)

Wiki - Trac

Creating a Wiki page

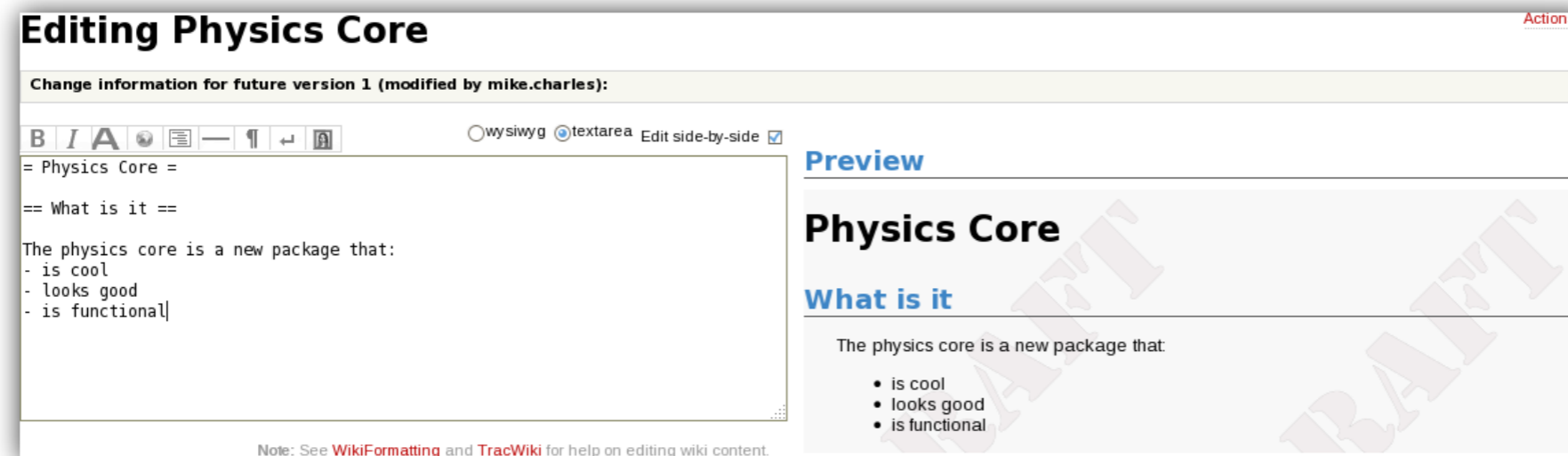
Step 1 - Enter the URL of a page you want to make



Step 2 - Click "Create this page", using an optional template



Step 3 - Add your content

A screenshot of the Trac Wiki editing interface for the page "Physics Core". The page title is "Editing Physics Core". Below the title is a message: "Change information for future version 1 (modified by mike.charles):". The editing area contains the following text: "= Physics Core =", "== What is it ==", "The physics core is a new package that:", "- is cool", "- looks good", "- is functional". To the right of the editing area is a "Preview" section showing the rendered page content: "Physics Core", "What is it", "The physics core is a new package that:", and a bulleted list: "• is cool", "• looks good", "• is functional". At the bottom of the page, there is a note: "Note: See WikiFormatting and TracWiki for help on editing wiki content."

Wiki - Trac

Keeps history of all Wiki edits

Change History for Coding Team/Coding Standards

View changes

	Version	Date	Author	Comment	
<input type="radio"/>	<input checked="" type="radio"/>	19	17 months	mike.charles	Added a link to ../Throwing Exceptions
<input checked="" type="radio"/>	<input type="radio"/>	18	22 months	mike.charles	Fixed the link to the EPG coding standards PDF
<input type="radio"/>	<input type="radio"/>	17	2 years	mike.charles	Renamed all links to using CamelCase
<input type="radio"/>	<input type="radio"/>	16	2 years	mike.charles	Added a section on using Javadoc
<input type="radio"/>	<input type="radio"/>	15	2 years	mike.charles	Cleaned up the "comments" section
<input type="radio"/>	<input type="radio"/>	14	2 years	mike.charles	developing...
<input type="radio"/>	<input type="radio"/>	13	2 years	mike.charles	Reorganized
<input type="radio"/>	<input type="radio"/>	12	3 years	mike.charles	Added a naming convention for variables that are really comma-delimited ...
<input type="radio"/>	<input type="radio"/>	11	3 years	melissa.ou	
<input type="radio"/>	<input type="radio"/>	10	3 years	mike.charles	Added information about naming specific kinds of variables
<input type="radio"/>	<input type="radio"/>	9	3 years	mike.charles	Added some information about the variables used to pass information ...
<input type="radio"/>	<input type="radio"/>	8	3 years	mike.charles	Changed the section on variable naming convention
<input type="radio"/>	<input type="radio"/>	7	3 years	mike.charles	Added a section for naming Java packages
<input type="radio"/>	<input type="radio"/>	6	3 years	mike.charles	Removed all sections specifically discussing Matlab features
<input type="radio"/>	<input type="radio"/>	5	3 years	mike.charles	Switched from the cable CSS class 'wiki' to 'custom', since I realized ...
<input type="radio"/>	<input type="radio"/>	4	3 years	mike.charles	Name changed from Coding_standards to Coding_Team/Coding_standards
<input type="radio"/>	<input type="radio"/>	3	3 years	mike.charles	Added a table of contents
<input type="radio"/>	<input type="radio"/>	2	3 years	mike.charles	Added additional guidelines
<input type="radio"/>	<input type="radio"/>	1	3 years	mike.charles	Added the help block section

View changes

Wiki - Trac

Visual diff between any 2 versions

Timestamp: *(multiple changes)*

Author: *(multiple changes)*

Comment: *(multiple changes)*

View differences inline

Show 2 lines around each change

Show the changes in full context

Ignore:

Blank lines

Case changes

White space changes

Update

Unmodified Added Removed Modified

Coding Team/Coding Standards

Tabular | Unified

v17	v19	
3	3	= Coding Standards =
4	4	= EPG =
5		In order to keep coding practices uniform across all of the developers, we need to follow some guidelines about how to write code. A great resource for us to begin with is the set of [http://www2.cpc.ncep.noaa.gov/cpc/CF/documentation.shtml coding standards] developed by the Engineering Process Group (EPG). Please see that documentation for more information.
	5	In order to keep coding practices uniform across all of the developers, we need to follow some guidelines about how to write code. A great resource for us to begin with is the set of [http://www2.cpc.ncep.noaa.gov/cpc/CF/documentation/EPG_Programmers_Manual_infomap.pdf coding standards] developed by the Engineering Process Group (EPG). Please see that documentation for more information.
6	6	
7	7	= Naming Variables =
...	...	
204	204	climateRegion NCDC Regional Climate Centers
205	205	state US States
	206	
	207	= Throwing Exceptions
	208	
	209	See [[wiki:../ThrowingExceptions]] for standards on throwing Exceptions in Java.

Revision Control

What is Revision Control?

- Managing and tracking changes to code, documents, and directories.

Revision Control - Subversion

Keeps history & log messages of all changes

View changes

Revision Log Mode:
 Stop on copy
 Follow copies
 Show only adds and deletes

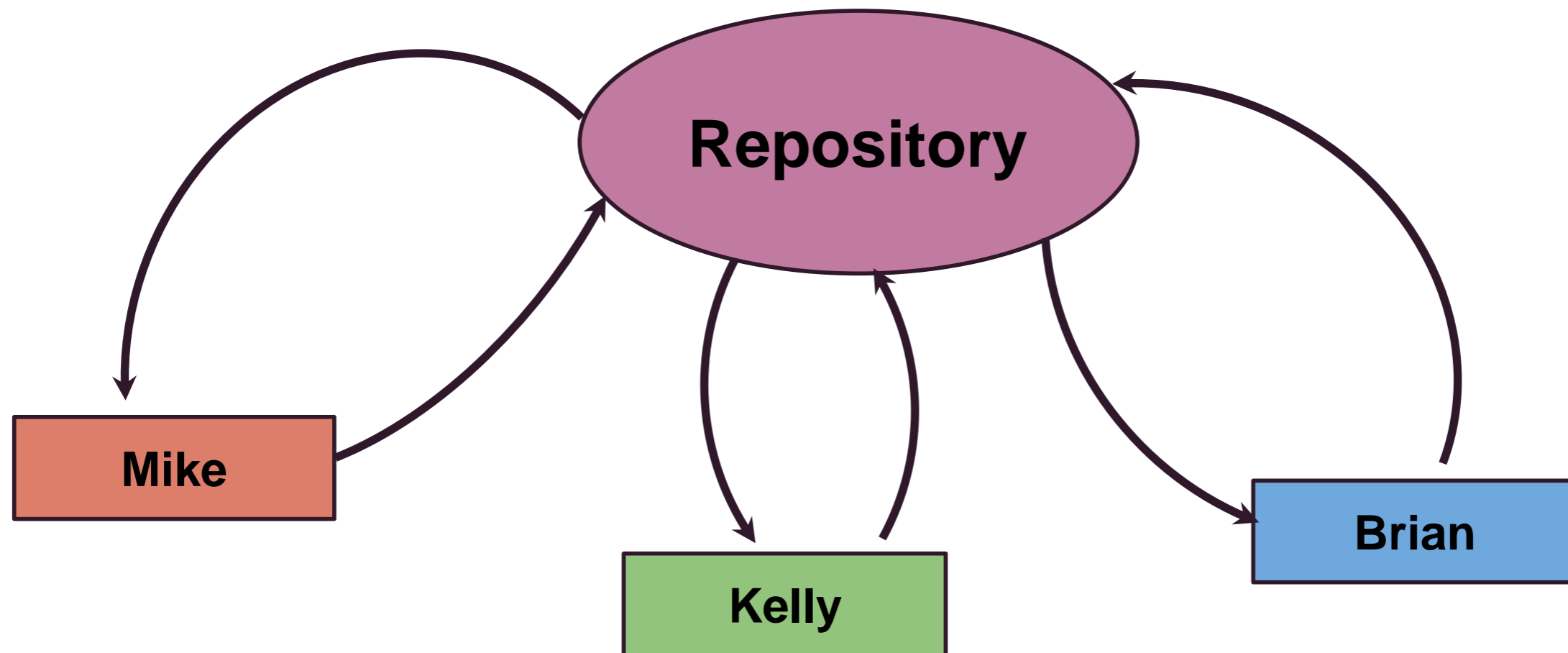
View log starting at and back to
Show at most revisions per page.
 Show full log messages

Added Modified Copied or renamed

Diff	Rev	Age	Author	Log Message
<input type="radio"/> <input checked="" type="radio"/>	<input type="checkbox"/> @4236	<input type="checkbox"/> 7 days	mike.charles	Modified the Ant target <code>package_web_dir</code> to copy the <code>verif_client.jar</code> ...
<input type="radio"/> <input type="radio"/>	<input type="checkbox"/> @4235	<input type="checkbox"/> 7 days	mike.charles	Changed build.xml so that all jar and war files are placed under a new ...
<input type="radio"/> <input type="radio"/>	<input type="checkbox"/> @4234	<input type="checkbox"/> 7 days	mike.charles	Forgot to remove this file after it was renamed in r4232
<input type="radio"/> <input type="radio"/>	<input type="checkbox"/> @4233	<input type="checkbox"/> 8 days	mike.charles	For some reason the "URL = " portion was missing.
<input type="radio"/> <input type="radio"/>	<input type="checkbox"/> @4232	<input type="checkbox"/> 8 days	mike.charles	Forgot to rename the conf file. See r4231
<input type="radio"/> <input type="radio"/>	<input type="checkbox"/> @4231	<input type="checkbox"/> 8 days	mike.charles	Renamed "static_db" to "direct_access" in all files. From now on run the ...
<input type="radio"/> <input type="radio"/>	<input type="checkbox"/> @4229	<input type="checkbox"/> 11 days	mike.charles	In r4203 I attempted to eliminate duplicates in the ResultSets returned by ...
<input type="radio"/> <input type="radio"/>	<input type="checkbox"/> @4226	<input type="checkbox"/> 2 weeks	mike.charles	Added code to copy the log4j config file (logConfig.txt) into the ...
<input type="radio"/> <input type="radio"/>	<input type="checkbox"/> @4225	<input type="checkbox"/> 2 weeks	mike.charles	The settings are now written to the settingsPanel at the bottom of the ...
<input type="radio"/> <input type="radio"/>	<input type="checkbox"/> @4224	<input type="checkbox"/> 2 weeks	mike.charles	Removed the password from getting printed in the URL that's logged before ...
<input type="radio"/> <input type="radio"/>	<input type="checkbox"/> @4223	<input type="checkbox"/> 2 weeks	mike.charles	Added code to print extra information about some of the exceptions.
<input type="radio"/> <input type="radio"/>	<input type="checkbox"/> @4222	<input type="checkbox"/> 2 weeks	mike.charles	Commented out the parts that access the database for the notes/warning ...
<input type="radio"/> <input type="radio"/>	<input type="checkbox"/> @4217	<input type="checkbox"/> 3 weeks	melissa.ou	Added comments regarding log levels in logConfig.txt, added Damian's ...
<input type="radio"/> <input type="radio"/>	<input type="checkbox"/> @4216	<input type="checkbox"/> 3 weeks	mike.charles	Added a scripts to create a default set of empty databases and table for ...
<input type="radio"/> <input type="radio"/>	<input type="checkbox"/> @4215	<input type="checkbox"/> 3 weeks	mike.charles	Removing the old database import initiation script.
<input type="radio"/> <input type="radio"/>	<input type="checkbox"/> @4210	<input type="checkbox"/> 3 weeks	mike.charles	Changed the size of the chart thumbnails so they're no longer stretched ...
<input type="radio"/> <input type="radio"/>	<input type="checkbox"/> @4207	<input type="checkbox"/> 3 weeks	mike.charles	Removed the ability to run the import script without first deleting that ...
<input type="radio"/> <input type="radio"/>	<input type="checkbox"/> @4206	<input type="checkbox"/> 3 weeks	mike.charles	Added some code to round leadTime up to an integer because the DateCalc() ...
<input type="radio"/> <input type="radio"/>	<input type="checkbox"/> @4204	<input type="checkbox"/> 3 weeks	mike.charles	- Raised the error threshold - Fixed a bug where the script was getting ...
<input type="radio"/> <input type="radio"/>	<input type="checkbox"/> @4203	<input type="checkbox"/> 3 weeks	mike.charles	Added extra SQL to ignore duplicate rows in the database. Closes #1243 ...
<input type="radio"/> <input type="radio"/>	<input type="checkbox"/> @4200	<input type="checkbox"/> 3 weeks	melissa.ou	Added fixed leftbar and header with links.

Revision Control - Subversion

Merges changes from multiple developers



Code is copied from repository, edited in each developer's isolated environment, then sent back to the central repository

Issue Tracking

What is issue tracking?

- Managing a list of issues or tasks
- Manage a list of "tickets" which can be assigned to different developers and store a history of comments made by any of the developers

Issue Tracking - Trac


Create ticket for a specific task or issue

Create New Ticket

Properties

Summary:

Reporter:

Description:  wysiwyg textarea You may use [WikiFormatting](#) here.

Type: <input type="text" value="defect"/>	Priority: <input type="text" value="critical"/>
Milestone: <input type="text" value="1.0"/>	Component: <input type="text" value="Web"/>
Version: <input type="text" value="trunk"/>	Keywords: <input type="text" value="firefox, ie, javascript"/>
Cc: <input type="text" value=""/> Edit	Due date: <input type="text" value="10/23/2012"/>
Hours spent: <input type="text" value="0"/>	Owner: <input type="text" value="bill.gates"/>

I have files to attach to this ticket

Issue Tracking - Trac

Anyone can comment on tickets, reassign, etc.

See [#1211](#)

Changed 5 weeks ago by mike.charles comment:5

In [\[4156\]](#): Reply Edit

Added code to check the age of the endDate, and force it to be old enough, if necessary, so that the aveWindow surrounding the endDate does not "spill into" the future.

See [#1211](#)

Changed 5 weeks ago by mike.charles comment:6

- **Owner** changed from *mike.charles* to *adam.allgood*
- **Status** changed from *reopened* to *assigned*

Adam, can you please test the static again?

Changed 5 weeks ago by adam.allgood comment:7

- **Owner** changed from *adam.allgood* to *mike.charles* Reply Edit

Ok, I ran the static LLF jobs again, and here's the results. The following jobs failed QC:

```
VARIABLE | SOURCE | SCORE | DATETYPE | RANGE | LEAD | WINDOW | PLOT
temp | manual | heidke | month | 8 | 02m | 03m | spatial
temp | manual | rpss | month | 8 | 02m | 03m | spatial
precip | manual | heidke | month | 8 | 02m | 03m | spatial
precip | manual | rpss | month | 8 | 02m | 03m | spatial
```

So just the seasonal "August" runs failed this time around, e.g., selectMonths = 08. Perhaps the code checking the age of endDate needs to push it one more month back if the forecast is seasonal?

Changed 5 weeks ago by adam.allgood comment:8

Actually, looking at your code, it seems right. If the middle date was two months ago, then there should be obs through the last month. Perhaps the August gridded obs (or JJA seasonal gridded obs) have not yet made it into the DB? Reply Edit

Changed 5 weeks ago by adam.allgood comment:9

Issue Tracking - Trac

List tickets using optional filters

My tickets (34 matches)

▼ Filters

Owner is

Status accepted assigned closed new reopened unassigned

And Or

► Columns

Group results by descending Show under each result: Description Max items per page



Milestone: 1.0 (2 matches)

Ticket	Summary	Status	Type	Priority ▲	Milestone	Component
#1004	Test For Static Web Page Browser Compatibility on Mac & Linux Platforms	new	task	major	1.0	StaticWeb
#1252	update documentation about where paths are for datasets	new	task	major	1.0	Code

Milestone: future (26 matches)

Ticket	Summary	Status	Type	Priority ▲	Milestone	Component
#661	Axis and date labels messed up in several browsers	new	defect	critical	future	Web
#669	Hide certain forecast sources depending on the spatial type chosen	new	defect	critical	future	Web
#1072	Implement test version of VWT on the dev server	new	task	critical	future	Code
#1073	Evaluate VWT functionality and performance on the dev server	new	task	critical	future	Web
#67	Clicking a region already selected in the VWT should unselect it	new	enhancement	major	future	Web
#235	Test the verification system on the CF2	new	task	major	future	Code
#300	Firefox on Mac - VWT spatial cannot display points on googlemap	new	defect	major	future	Code
#342	Separate manual into with EC and non EC as a forecast source for monthly and seasonal	new	task	major	future	Web
#396	Implement a way to dynamically determine all existing fcstSources	new	enhancement	major	future	Web

Subversion/Trac Combo

- RSS feed support 
- Email notification of changes to tickets 
- Create milestones
- 100s of plugins available for Trac
- View source code & Subversion code history within Trac
- Connect specific tickets to specific code revisions
- Use Trac to keep track of all work done on a project

Summary

- Current practice in many organizations is for developers to work alone on software
- Better practice is to work collaboratively
- Wikis help a team share documentation
- Version control helps track changes to code and revert to any previous version
- Issue tracking helps developers assign tasks and track work on issues and tasks
- We should all use open source software as a model for efficient, creative work

Thank you

Trac - <http://trac.edgewall.org>

Subversion - <http://subversion.apache.org>

Any questions - email me at mike.charles@noaa.gov