Documentation of Water Climate Toolkit Usability Review

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This document describes a user interface usability review conducted as part of a webpage redesign process for the Northwest Climate Toolbox (https://climatetoolbox.org/). The Toolbox provides a variety of options for customized access, analysis, and visualization of climate-related data in four application domains: agriculture, water management, fire, and climate monitoring.

Review context

At the beginning of the CIRC 2.0 project, elements of the Northwest Climate Toolbox had been developed within a variety of projects by different teams at the University of Idaho and the University of Washington. Loosely named the ag/climate toolbox and the water/climate toolbox in the CIRC 2.0 proposal, these collective elements evolved in their application domain, functionality, integration, and "look and feel" as the development teams engaged with decision makers and others in the CIRC 2.0 project. The challenge for the Toolbox development team was formidable -- balancing demands for real-time code maintenance, continued tool development, and outreach to potential users that included creation of toolbox-based stories, social media engagement, and participation in onsite meetings with users, all on a budget of $25,000/year.

Under CIRC 2.0, development of decision support tools, such as the Northwest Climate Toolbox, was to be informed by iterative assessment and evaluation from multiple perspectives, including from the perspective of users of the tools. Frameworks for decision support tool assessment and evaluation were presented in an overview report (Hartmann, 2016) and through a series of ten webinars over the period October 2016 – March 2018. Given the practical constraints facing CIRC 2.0 DST development teams, the frameworks were not prescriptive, but available for tool development teams to use as their time, budgets, and interests allowed.

The first consultive evaluation with the Toolbox development team (see Table 1) used the AgClimate Atlas tool as a focus for clarifying development challenges, choices, and constraints facing the team, and then explored how selected framework elements applied to their tools in practical terms. Extended discussions at the CIRC 2.0 2017 retreat (see Table 1) involved other CIRC 2.0 teams, shared the challenges facing DST development projects, and highlighted the need for DST assessment and evaluation to serve the development teams rather than drive their agenda or software requirements.

Review process

The user interface usability review was requested by the Toolbox development team. In light of concerns expressed at the CIRC 2.0 2017 retreat, the review process was designed, explicitly, as a simple collaborative discussion process. The review process was, explicitly, not a process for publication or for project evaluation. Review comments were not judgments about the development team's skills, choices, or processes. They were not a documented set of deficiencies or problems requiring any justification, response, or change by the development team. There was, explicitly, no tracking of changes made, or not made, in response to the discussion process. The review process was simply to support the Toolbox team in their development process.

The discussion format was selected to reduce communication confusion and misinterpretation that can occur with written reviews, to allow the development team to discuss issues together, and to build trust in the CIRC 2.0 assessment and evaluation effort. The discussion format enabled continual reinforcement that the review was to serve the team; it was their process and their decisions about the pace and scope of the review, and any response to review comments.

The Toolbox team selected the Climate Mapper (https://climatetoolbox.org/tool/Climate-Mapper) for the user interface usability review. In preparation for the review discussions, I looked at every element and option offered by the Climate Mapper Tool. The review was structured by following each tool option to its conclusion, page by page, option by option, click by click, for each element and item, including external links. Every aspect of the tool was reviewed across multiple dimensions, including:

- Functionality:
    - Does each page and option perform as intended?
    - Are tool functionalities aligned with the needs of its intended audience?
- Form:
    - Do page layouts conform to good web interface design principles?
    - Are pages, their elements, and resulting products aligned with abilities and expectations of the intended audience?
- Format:
    - Are pages, elements, and products in accessible formats?
    - Are spelling and grammar correct?
    - Do the pages and elements use appropriate icons, fonts, colors, and layout?
    - Do analytical and graphical products have appropriate colors, legends, titles, logos, and attribution?
    - Do text and products follow best practices for science translation and climate communication?

Review discussion occurred in six meetings over February-March 2018 (see Table 1). While the review encompassed each tool option, page, page element, and product in detail, issues having larger scope were noted and discussed as well, such as consistency and connectedness to other tools and products (e.g., official NOAA tools and products), managing myths and misunderstandings in climate science applications, and capacity limitations of the development team to design and implement tool changes beyond software code.

Table 2 provides a detailed list of review comments and questions brought to the discussions for the Climate Mapper tool. Many comments have not been altered from the original review notes. The language is informal, intended to prompt engaged discussion rather than benchmark the tool. The comments and questions in Table 2 do not reflect any judgement about the skill or prior choices made by the Toolbox development team. The contents of Table 2 are not intended for use in external publications, except in summary form or with approval of development team members.

After each discussion session, the development team did make some changes to the Climate Mapper tool, requiring some re-review or adjustment of review comments in subsequent sessions. The group considered a complete second iteration of review at the end of the six meetings, but ultimately decided to focus on implementing changes in the Climate Mapper, and to use insights from the review to guide the redesign of other tools within the Northwest Climate Toolbox, as well as to inform expansion of Toolbox components and functionalities.

Some discussion during the review addressed issues beyond the capacity of the toolbox development team to decide or implement. These larger issues were periodically brought to the attention of the larger CIRC 2.0 group during monthly project meetings. Some of those issues were addressed during the 2018 CIRC 2.0 retreat, including during a focused breakout discussion session (see Table 1).

Based on the usefulness of the user interface usability review, the Toolbox development team requested similar reviews for four additional tools over September-October 2018 (see Table 1). The process was the same as for the Climate Mapper tool, addressing similar topics. There were fewer review comments, however, because many changes in the Climate Mapper tool had propagated throughout multiple tools within the entire Toolbox.

DST improvements as a result of review

While changes in specific user interface elements were, explicitly, not tracked in the review process, some larger-scope changes are notable. As the review proceeded, focusing on specific elements of the Toolbox, the development team found the abstract evaluation and assessment concepts of the webinar series to be more concrete and understandable. Even though the review focused on user interface usability, connected discussions helped the development team appreciate, in practical terms, the importance of other aspects of decision support tool evaluation and assessment, including suitability, utility, sustainability, as well as other aspects of usability.

Scoping the intended audience for the Toolbox to be information intermediaries was significant, since the intended audience is so strongly tied to fundamental design priorities. Information intermediaries include extension agents, consultants, technical support staff, and advisors. They may or may not be influencers, depending on the decision context, but they are science translators with technological, analytical, and application domain knowledge and skills greater than many stakeholders involved in decision processes. Further, these intermediaries value stability of decision support tools and effectiveness in how the tools and products connect with needs of their clients, compared to research-focused users seeking innovation even at proof-of-concept status.

Even though the review was focused on web interface usability, other significant improvements also occurred because the process tracked issues that were beyond the scope or capacity of the Toolbox development team, and brought them to the attention of the overall CIRC 2.0 team. A key issue was that improving the suitability, utility, and sustainability of the Northwest Climate Toolbox requires skills and resources beyond those of the coders and scientists comprising the development team. The review process highlighted the development team's need for help with the following:

- Example applications. These could be as tutorials or case examples, from respective application domains, e.g., fire, water management.
- Cleaner, clearer language throughout the Toolbox, including better descriptions, instructions, and explanations. This may include a glossary or external pages for supporting terms and concepts.
- Dealing with myths and misconceptions in climate science and applications (e.g., the difference between weather and climate). Need guidance and language, based on social science and communications expertise, on what and how to integrate user learning in the toolbox, or to support toolbox users with handling misconceptions that their clients have.
- Design improvements to get more information on a given image. Key information to add: (1) logos, (2) help with the tool, and (3) assistance in interpreting results. This

includes appropriate visualization color palette choices and selection assistance (e.g., divergent palettes, sequential palettes).

- Connecting decision makers and organizations with the Northwest Climate Toolbox, including with other CIRC and non-CIRC products. Help decision makers know why they should choose specific tools within the Toolbox, and instead of tools offered by others (suitability). Help decision makers know how to integrate Toolbox tools and products with decision processes (Utility).

Significantly, after the 2018 CIRC 2.0 retreat discussions, other CIRC teams committed and have contributed to the success of the Northwest Climate Toolbox, in ways well beyond earlier activities (e.g., the style guide, using toolbox products in CIRCulator stories). CIRC's Science Writer worked with the Toolbox development team to incorporate cleaner, clearer communication in Toolbox descriptions, instructions, and explanations. The Northwest Climate Toolbox Workbook (Mooney et al., 2019) is a user guide to the toolbox that also helps users develop case studies of how climate information connects to their domain and appreciate how toolbox products integrate with their decision processes. It provides a significant improvement in the usability and utility of the Northwest Climate Toolbox.

Review of the review process

Reflecting on the user interface usability review process, some lessons stand out.

Developing trust with the Toolbox development team was important. Appreciation that the review process would support the development team, rather than judge the project or drive the team's agenda with new requirements, helped defuse what could have been seen as confrontational comments. Some issues were difficult to discuss, having no easy solution because their scope exceeded the resources of the development team. The webinars and frameworks provided a common reference that was helpful in addressing difficult topics that extended beyond the user interface, such as design choices, resource limitations, and expectations for decision support development efforts within scientific research projects. Reviewing the user interface at all levels, from simple (e.g., typos) to complex (e.g., design choices) allowed progress with every meeting, even as some issues were set aside to address in other venues (e.g., the 2018 CIRC 2.0 retreat).

Although the user interface review for a single tool, the Climate Mapper, took many hours and meetings, the process became increasingly more efficient. Some early review topics required extended discussion, not because that specific tool component was such a problem, but because it simply was the first encounter with a topic that required taking time to ensure clarity and common understanding of the issues and options. When encountered again in another part of the Climate Mapper (or other tools in the later review), those topics could be simply pointed out, without needing further discussion. In addition, many early changes in the Climate Mapper propagated across that tool and then to others in the entire Northwest Climate Toolbox.

One of the most challenging discussion topics concerned the intended audience for the Northwest Toolbox in general, and the specific tools. The choice of audience is a fundamental question that affects overall design, for example reflecting the audience's prior knowledge, leading to specific requirements for language and supporting material for each Toolbox component. There is not necessarily complete agreement across the whole Toolbox team, and there is perceived pressure to also serve 'end users' directly, as well as climate science application researchers. Serving those audiences poses fundamental

design challenges, including the diversity of stakeholders that comprise the 'end user' audience, and researchers' preferences for novel algorithms and products over slowly evolving standardized options.

References

Hartmann, H.C., 2016. Decision Support Tool Evaluation Methodologies and Frameworks. Report submitted to ehe Pacific Northwest Climate Impacts Research Consortium (CIRC), College of Earth, Ocean, and Atmospheric Sciences, Oregon State University.

Hegewisch, K.C., Abatzoglou, J.T., Chedwiggen,O., and Nijssen, B., NW Climate Toolbox. (https://climatetoolbox.org/).

Mooney, Ann, Nathan Gilles, Katherine Hegewisch, John Abatzoglou, and Meghan Dalton. "The Northwest Climate Toolbox Workbook: Discovering and applying your climate data story for climate adaptation planning," Corvallis, Oregon: The Pacific Northwest Climate Impacts Research Consortium (CIRC), College of Earth, Ocean, and Atmospheric Sciences, Oregon State University, 2019.

Table 1. Review Activity Summary

Review Activity	**Date**	**Direct Engagement Effort**
1. Initial Review	May 2017	2 hours, 1 meeting
Focus ***Demonstration:*** AgClimate Atlas Tool ***DST Challenges:*** • Funding: shoestring, leveraging • Maintenance: >1 month/year, challenges with ongoing changes in data and server reliability ***Discussion:*** Evaluation Framework elements of interest to DST team (design, usability, utility, suitability)	**Results** ***Design Decisions:*** • Want a common look and usability across tools within the Toolbox • Modeled after ACIS tools • Provide raw data, visualizations, customized analysis and visualizations • Audience: scientists, decision makers, intermediaries • Uses: real time information, information for adaptation • Hydrology: will limit area to NW and Columbia Basin into Canada ***Action Items for DST Development Team:*** • Create design template: Work with CIRC co-production team to develop design templates for products and interpretive text. • Create drop-in pngs of maps • Create Boilerplate text: customized text, attributions, links to tool • Create reports of how to use this information	

	• Improve credibility of tool
	  ○ Add citations to tools under 'About Data'
	  ○ Create simple fact sheets
	• Map out where DST fits amongst other tools
	• Develop presentation on REACCH user testing results for CIRC
	• Get a CIRC person to go through the language used on one tool and provide edits/comments

2. Retreat Discussion	June 2017	2 hours, 1 meeting

<u>Focus</u>
Discussion:
• Issues across CIRC DST projects
• Demands on DST development teams
• Role of DST evaluation
• Initial evaluation recommendations
	<u>Results</u>
	Action Items for CIRC teams:
	• Regularize WCT stories in CIRCulator
	• Use style sheets for
	  ○ Language consistent with official products (e.g., IPCC, NCA)
	  ○ Design specs for graphics and titles
	• Continue DST evaluation webinar series
	• Develop trust that evaluations are to assist the DST teams, not to judge their projects or add to their work requirements	

3. Detailed Review	February-March 2018	6 hours, 6 meetings

<u>Focus</u>
Tool: Climate Mapper
User Interface Review:
• Functionality
• Interface usability
• Information interpretation
• Connection with utility, suitability, sustainability, and other aspects of WCT usability
	<u>Results</u>
	Design Decisions:
	• Scoping of intended users to information intermediaries
	• Citations and creative commons licensing
	Action Items for WCT team:
	• Modify WCT code and products based on user interface review
	• Bring issues to overall CIRC team
	  ○ Need CIRC team involvement for user outreach and engagement, development of ancillary material, training
	  ○ How to connect with other regional/national decision support and training (RISA, NOAA, COMET)
	• Address suitability, utility, sustainability, and other aspects of usability of WCT	

4. Retreat Discussion	June 2018	2 hours, 1 meeting

Focus

Discussion:

- What does WCT success look like?
- Can other CIRC teams support WCT development?
- Year 3 WCT development plans

Results

Success Metrics:

- Toolbox serves the needs of CIRC projects
- Toolbox in use across the RISA network
- Toolbox is a designated source of information for specific decision-making processes, for example:
  - In the Spokane team/community project
  - In the OWRD team/community project
  - Designated by NIDIS Coordinator for the DEWS network to communicate climate information
  - To inform Drought Status updates
- WCT team gets additional funding support
  - Additional RISA/CPO funding (e.g., for cross-RISA/cross-agency cooperation efforts)
  - Other proposals leverage the toolbox development
  - Letters of support from users

Year 3 WCT Development Plans

- Continued WCT development
  - Add seasonal forecasts to mapping interface
  - Integrate the Climate Engine
  - Add specialty crop mapping
  - Add rangeland allotments (CA/NV/S-ID) with hydrology components (multiple hydro models, met forcing from medium-range weather forecasts, NCEP's NMME output)

Action Items for CIRC and WCT teams:

- DST development supported by other CIRC teams
  - Ancillary material (e.g., user workbook, training material)
  - User outreach and engagement (e.g., via community projects)
- Continue DST evaluation discussions
  - Communication
  - Design/Usability
  - Techniques

5. Walk-through of Other Tools	September-October 2018	4.5 hours, 3 meetings
Focus ***User Interface Review:*** upon request of WCT team	**Results** ***Tools reviewed:*** • US Water Watcher (https://climatetoolbox.org/tool/US-Water-Watcher) • Crop Suitability Tool (https://climatetoolbox.org/tool/Future-Crop-Suitability) • Climate Normals Tool (https://climatetoolbox.org/tool/Historical-Climate-Normals) • Climate Tracker Tool (https://climatetoolbox.org/tool/Historical-Climate-Tracker) ***Action Items for WCT team:*** • Modify DST code and products based on user interface review	

Table 2. User interface review for the Climate Mapper Tool in the Northwest Climate Toolbox

NOTE: THIS TABLE IS FOR INTERNAL CIRC USE ONLY. CONTENTS ARE NOT INTENDED FOR USE IN EXTERNAL PUBLICATIONS, EXCEPT IN SUMMARY FORM OR WITH APPROVAL OF PROJECT PARTICIPANTS.
Note: Many comments have not been altered from original discussion notes, which were intended to prompt discussion rather than be a software modification requirements document. The language is informal and does not reflect any judgement about the skill or prior choices made by the WCT software development team.

Topic 1 – General discussion about the tool

APPLICATION DOMAIN

• Who is using this tool? How are they using it?
• Who are your 'design' customers/clients/users? What are your design priorities?
  ○ If the users are farmers and land managers as "end users", then does your tool have equitable access, e.g., for minority farmers, new farmers, section 508 complicance
  ○ If users are corporate ag operations, are you focused on their return on investment (ROI)? Do they have internal tools that you are connecting with, replacing, adding to, transferring to?
  ○ What about intermediaries as users? Examples: consultants, extension agents, agency analysts and technical decision support staff
• What other choices for DSTs do your users have?
• What does this tool do that your 'competitors' don't?
• See CBI for examples of a good approach to this topic.

Topic 2 – High-level tabs for user navigation

OVERALL PAGE

The additional restrictions here do not conform to the CC-BY-4.0 license. You say, “Use as is”, but the license says people can transform. Suggestion: use the language under the attribution statement. Be explicit. For example, to use figures: credit in the lower corner of the figure must be visible, e.g., in a broadcast or publication.

TOUR

It told me to do something. I did it. The help went away. Need something that stays available as a person takes the tour.

ABOUT THIS TOOL

- Creative Commons issues
  - Need the specific license: CC-BY 4.0
  - Is your university/institution OK with that license?
  - Link to the license, not the human readable summary page.
  - Is this license OK for the data base, too?
- Citation
  - Include the release version, so if anything changes, then folks can know which algorithm was actually used.
- Release Version
  - Is this a real ‘release 1.0’ or is it a Beta version?
  - Use revision or release numbers so people can know when it’s been changed.
  - Do you have an update schedule, e.g., every 6 months, where all fixes are incorporated and released? Or is it ad hoc?
  - Have page/notes of release dates and release notes, about what has changed.
  - Related: do they use a version control system for their software? Do they use GitHub?

ABOUT THE DATA

- Lots of links to other projects that have other tools. It looks like those tools compete with this one. Is that the message you want?
- Observed Hydrology Data
  - No link to VIC
  - Which VIC are you using? The mass balance only, or the mass and energy balance VIC?
  - Are there release versions of VIC to reference?
  - You really want to link to the specific information, not make people hunt and peck. For example, for VIC, “Data Catalog for Integrated Scenarios”, is that really the right place to send people?
- Observed Climate, Ag, Fire Danger Data
  - Goes to GridMet: what audience is that written for? Does that match your audience? Or does there need to be a translated version of that information?
  - Some important information is hidden so deep in here. For example, I only find out from this section that the Fire Danger is for “Dense Conifer Forests”, not rangelands. Further, it’s just for dense Hemlock-Sitka, coast Dougfir, and killed Lodgepole Pine and Spruce. Is there a mask of applicability for the Fire Danger variable? It’s misleading to show results where there’s no dense conifer forests.
- Downscaled NMME
  - Goes to visualizers and plot/analysis tools that look like they compete with yours
  - “seasonal forecast models” really is just 1 specific data set

- Downscaling approach not clear
- Future Climate Data
  - MACA v2: is the 'read more' or 'about data' that matters? The latter has a lot more readable information that explains the advances in MACA from version 1 to version 2 (the use of version 2 is one advantage of your tool)
  - The MACA FAQ that you have a link for, has problematic information, e.g., confusing reference periods. Bottom line: you need to be in control of the messages for your users. When you link out to places that confuse that message, that's harder for users.
- Future Hydrology
  - This goes to a general page, that then goes to a data catalog, that then goes to a table – that still doesn't describe VIC.
  - There a 'download data' with no description, and then I'm trapped, with no way back to where I was in the too.

ABOUT VARIABLES

- Climate
  - Generally good
  - Missed an opportunity to define the "historical baseline"
- Hydrology
  - Uses the term 'normals'. Should not be using this term. Further, you use 'historical mean' in the very next sentence. And that's without describing the historical reference period.
- Ag Climate
  - Nice how you link to definitions. It would be good to do this as much as possible.
  - The other variables (climate, hydrology) refer to official definitions. But here, you're referring to the American Horticultural Society. Is there an official reference to use instead?
  - 'Days since 0.25% of precipitation' -- % of what? Daily mean, monthly total? Be specific.
  - Fire: see comment above about fire danger. Is there a mask for this? If so, say it here.

EXAMPLE

- Data Source: 'Historical=1971-2000'. Is this true for all ag variables? If so, this should be in the 'About Variables' section.
- Also, you said Hydrology uses 1981-2010. Either be consistent, or make clear in each location, that you are using a different historical reference period.
- First time I've seen the terms 'multi-model mean' and 'RCP 8.5 2040-2069'. They need to be defined before people encounter them here.

TAKE SURVEY

Looks ok

TAKE A TOUR

With this pathway, the tour stays persistent. = Different functionality than the "TOUR" link mentioned above. Why are they different?

Topic 3 – Sector analysis interfaces and results

CLIMATE

- Mean Temperature Anomaly
  - 'Normal' needs to be replace on titles and in legends. It's more than a language issue. It's a statistical issue. Precipitation is not a normally distributed variable and should not be presented as one. Even though temperatures are, then you are asking people to interpret

the two variables in different ways. It's more appropriate to use percentiles or medians, which works for all variables. You are not trying to communicate an expected value.
    - Uses reference period 1981-2010.
- Temperature Percentile
    - Uses reference period 1979-2015. Why is this different from 1980-2010 reference period?
    - 'current water year'- why use more than the 15-45 days you said were appropriate in the MACA FAQ?
    - Percentiles on the legend: it looks like there is a >100% and a <0%. Is the interpretation that this is outside the historical range (1979-2015)?
    - Looking at the values in the graphic, is there a real story to tell, that in some parts of the West, there is really early plant activity?
    - Too easy for the source data to get cropped off.
    - Are these maps actually following the license required by the data providers? For example, if they are requiring attribution and a link to their license, that needs to actually be shown. If the data are being used by permission, that needs to be explicit.
    - Logos: include logos of the agencies and organizations (e.g., NOAA, NASA, U-Idaho). This makes clear the sourcing of data, and helps build support for public funding of climate science. Ask for help from CIRC team for graphical design, if needed.
- Percentile Anomaly
    - Not consistent language or format for titles on products. Choose one and stick to it across the products.
    - No 'hydrology for future conditions' in options.
- Hydrology
    - What is the time period?
    - It looks like summaries will be averages. Need clear communication.
- Total Runoff
    - No description in the 'About Variables' section
    - Units? You use inches, but that really seems like 'inches over the area', without providing the area. So there's no real sense of the volume of water.
- GeoLocate
    - Doesn't work? Doesn't do anything.
- Point Values
    - Are there any variables where point values actually have meaning? There doesn't seem to be. So why is this here?
- Change Mapping
    - Color options: you offer some options. But offer some meaningful options, like different colorblind palettes, or palettes that are consistent with other products that users are familiar with (e.g., NWS/CPC, IPCC/NCA).
    - Color palette: DDA doesn't do anything. # colors, and colors out of range sometimes don't work; the situation is changeable.
    - Why does change mapping change for some variables, like temperature vs hydrology. If it's about 'change', and not the variable itself, it's confusing to change colors; users have to reinterpret and it's easy to think the map is about the variable, not the change.
- Add Features
    - Gridlines: are these the same grids as other projects, or not? Better if they are compatible with other projects (and say which ones, to help people connect results with other tools they may be using).

- Projections
  - What is the current projection?
  - Can people get shapefiles so they can map using their own projections? Not everything else maps to Google Maps and Google Earth projections.
  - If folks want to apply the data to another projection, where can they find the details of your projection?
  - Need somewhere (or where is it) that results don't change just because the layers change (e.g., HUC). Or are results for visualization only and not for any numerical use.

HYDROLOGY

- About Variables
  - SWE Percentile: Give an interpretation of percentile. It's not explained anywhere.

AGCLIMATE

- About Variables
  - Palmer Drought Severity Index isn't anywhere on the list, even though it's a variable
  - Chill Hours: not a defined variable – you have 3 different definitions. How will someone know which is which, and which is appropriate for what use?
- "Normal"
  - Pervasive in the titles and legends. Better to use 'MEAN' if that's what you are actually using (with caveat that you will be requiring people to switch notions of central tendency when dealing with non-temperature variables). Even better, include the appropriate reference period used to compute the statistic in the graphic, e.g., 'Departure from 1981-2010 Mean'.
- Chill Units (Utah)
  - No time period, e.g., 7 days, 90 days.
- Days Ahead
  - For 40 degrees, the Calendar year options produces lots of missing areas. But the water year option does not.
- Anomalies: Max Temp, Min Temp, Precip, PET
  - The word 'anomaly' needs to be in the title.
- Percentiles: Max Temp, Min Temp, Precip
  - Title is inconsistent with what's used with the CLIMATE PERCENTILES in the climate tool. What are the actual units? The titles here say "% in 1979-2015".

FIRE

- Fire Danger
  - Explain the big discontinuities at the US-Canada border for "Days since >0.1" Precipitations" and "Days since >0.25" Precipitation". With no explanation, it raises questions about the accuracy of the information.
- Energy Release Anomaly
  - What are the actual units? Showing energy/area, when the definition of energy release requires units of energy.
  - 'Normal' not appropriate.
- Burning Index Anomaly
  - Typo.
- 100 Hour Fuel Moisture
  - What's up with the stripes and the US-Canada border? With no explanation, it raises questions about the accuracy of the information.

- What are the units? The legend says “Dead Fuel”, but if it’s % dry weight, need to say that somewhere.
- Legend: anomalies? Units?

- Weather vs. Climate
  - Tool uses “weather” for 7-day, 13-day, and 30-day time horizons. The NWS calls specific 1-month products, like their outlooks, “climate”.
  - How are your products produced, in comparison to NWS products? What is your unique value, or are they the same products?
  - Titles: “Weather” forecasts do not include NMME in the title, but the “Climate” outlooks do. They should be consistent, if they are both using NMME.
  - “Climate” should say BCSD-NMME. The downscaling method important, not just the underlying models.
- Climate
  - Tool Tip: uses Temperature example. What about precipitation? It’s not handled the same way as temperature.
  - Mean Temperature: Why is “average” in the time period definition? (Same comment for the WEATHER product as well).
  - Mean Temperature: Why are MAR-MAY values missing?
  - Precipitation: Is the tool really showing 6-7 inches of rainfall in Eugene, OR for June? That seems unrealistic. It’s not reflective of climatology at all.
  - Precipitation: The legend is not changing between the 1-month and 3-month products. So the precipitation total for APR-JUN is less than the total for only JUNE for Eugene, for example.
  - Total Precipitation Value: What does “average total” actually mean for a 1-month period? How is an “average” for 1 month of a 3-month outlook period really relevant? Precipitation is not uniformly distributed across any 3-mohth period.
  - Total Precipitation: APR-JUN missing data, and what are those stripes on the images?
  - Mean Temperature Anomaly: Legend should say “anomaly” in it
  - Precipitation Anomaly (%): what are those specific values in the legend? They are not intuitive values. Nor are they consistent official NWS CPC Climate Outlooks. Should have some consistency with official NWS products unless there’s a good reason for using something else.
  - (Re-review): It looks like there is no way to know, within the tool, what the range of historical conditions are. Do I have to do to “Projected future conditions” to see the “historical conditions”? Note that “historical conditions” are not really historical observations, but it’s the multi-model mean of a baseline set of model runs.
  - Mean Temperature: In the legend, are these breakdowns meaningful or an artifact from something? An 11 degree step doesn’t seem intuitive or meaningful.
  - Precipitation Anomaly: should not be in the “historical” scenarios section
  - Growing Degree Days: titles should be consistent with the Climate DST component’s “Recent and Past Conditions” products.
  - Growing Degree Days: those units are awkward. Is that how folks are used to seeing this kind of information?
  - Growing Degree Days (above 32F): There’s no time period used (like DJF). So what does this really mean? Is it a 3-year accumulated GDD? How is this decision relevant? Should it be some kind of average for the DJF period?

- Growing Degree Days (above 32F): Title can't be right. Are there really 360 days less than 32F? Should it be >32F? See your Freeze Free Days product (e.g., annual average of days <32F).
- Last Spring Freeze Date: Title: Is it really a date, or a number of days since January 1, or day of year?
- Warm Days: The legend should have number of days.
- Coldest Night: the title needs to say "Temperature" somewhere, with the units, too.
- Hottest Day: same comment as for Coldest Night.
- Hottest Day: the legend looks unhelpful, since even with worst scenario doesn't reach the top 4 categories. i.e., the top 4 categories in the legend exceed all values shown. I didn't look at all the other variables, though, so the legend categories may be an artifact of values somewhere else. The legend should have meaningful values, not artifacts.

- Projected
  - Climate: what does "Historical 1971-2000" mean? Can't just say "historical" because it's really from a model using historical emissions. Further, are the models using actual historical emissions or some type of average historical emissions? If the latter, what's the period used for computing the averages, and what kind of average is used (e.g., mean)? Nothing is mentioned in the 'more info' link.
  - Be consistent, within the tool and with official products, in the use of terms. Is it "baseline" model runs or "reference" model runs?
  - Link to model descriptions. Otherwise, folks won't know what terms like 'r1i1p1' or 'r6i1p1' mean.
  - Check use of "Historical" and terms to refer to reference base models within CMIP5 or IPCC. Try to be consistent with their terminology and/or titles. For example, titles or descriptions, somewhere evident to anyone looking at a product, should include the models used, the down-scaling and bias-correction used, and the reference period that's the basis of any comparison content.