

An Emerging Protocol for Research-to-Operations (R2O) at CPC

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Overview

Over the last several years CPC has created products and adopted protocols which are new to the organization. The net result is an emerging R2O protocol, whose evolution we will describe.

We identify 5 critical elements:

1. Project Planning
2. Software Version Control
3. Issue-Tracking
4. Wiki usage
5. Collaborative Software Development

And 2 project examples:

1. A Verification web tool (VWT), and
2. A Dynamic Probability of Exceedance web tool (dPOE), both of which are nearing completion.

Outline

- “R” and “O” Comparison
- Elements of a new R2O: Project Planning, Version Control, Issue-Tracking, Wiki, Collaborative Development
- CLIMAS FET – Inspirations for VWT, dPOE
- Verification and Dynamic POE Web tools
- Results
- Future

Comparison/Contrast of Research/Operations

Research:

- Exploratory, evolutionary, prototypes
- Funding controls focus
- Focused on new results
- Product delivery is flexible
- Coding standards and documentation sometimes limited
- Limited user base, often technically-savvy

Operations:

- Robust technologies, continuity valued
- Funding/resource limits ability to do new things
- Routine/rigid delivery of products
- Code standards, documentation essential
- Driven by system *security considerations*
- Software maintenance is largest cost
- Broad user base, often untrained

Essential Project Elements

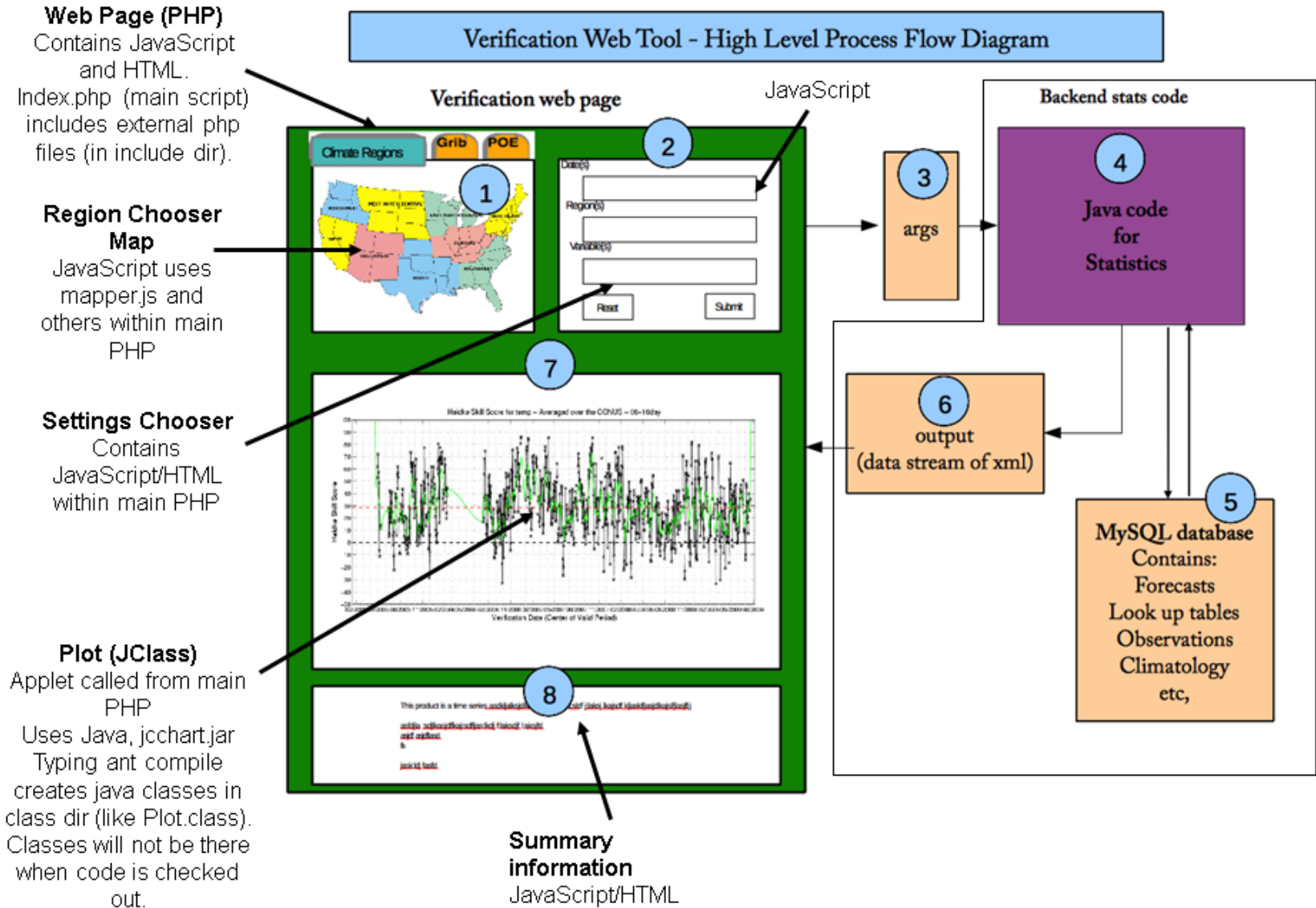
These 5 elements were key:

1. Collaborative Development : Leverages the talents and resources of developers inside and outside of the organization.
2. Project Planning : A formal process, starting with a Charter, which lists purpose, in and out of scope activities, costs & benefits, deliverables, resources, risks, participants.
3. Software Version Control: Facilitates orderly code development and is essential to collaborative development.
4. Issue-Tracking : Facilitates management of project through accountability.
5. Wiki-Usage: Enables shared documentation of information.

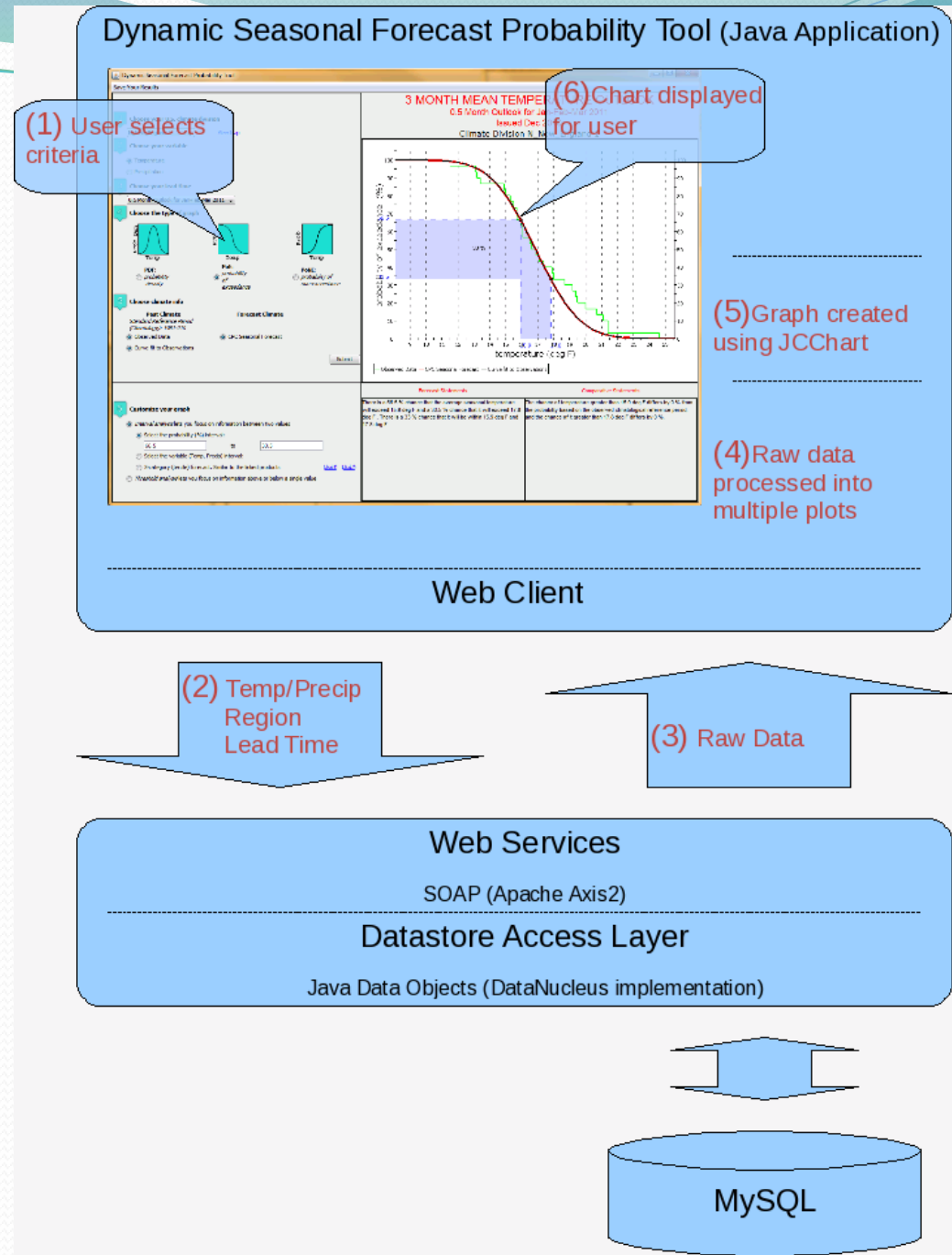
CPC/CLIMAS Successes

- Web services
 - Dynamic process initiation from user interfaces
 - Usability Testing
 - CLIMAS introduced software development tools
 - Bugzilla, and eventually, Trac
 - CVS, and eventually, Subversion
 - Climas' FET inspired CPC Verification Web Tool
 - Dynamic POE Enhanced Forecast Tool
- * Also important: Security issues with non-NWS access to NWS computers,

Verification Web Tool: High-Level Design



Dynamic POE Web Tool: High-Level Design





Verification Web Tool

CPC Verification Web Tool

Overview

The verification web tool (VWT) is an interactive verification system at the Climate Prediction Center. The VWT allows users to evaluate forecast performance to aid in decision making using a variety of skill measures.

Instructions for Use:

- 1) Select type of skill score output display desired ("Chart" or "Map").
- 2) For "Chart", select region(s) to verify ("Climate Regions", "States", "Climate Divisions"). For "Map", select date(s) to verify ("Date Range", "Months/Seasons & Years", "Climate Phenomena").
- 3) Select Forecast and Verification Options.
- 4) Click the "Get Scores" button.

Results display

Chart Map Tutorial

Scroll down the page to see the results, error messages, and information panel.

Climate Regions States Climate Divisions

Select region(s) to verify

To unselect, you must clear all regions by clicking "Revert to all regions". All regions are verified by default.



Revert to all regions

Options

Forecast options

Field [?]

Period [?]

Lead time [?]

Data format [?]

Forecast(s) (Select up to 4) [?] CPC Official (Manual) CPC Official (Auto) [Select forecast models](#)

Verification options

Start date [?]

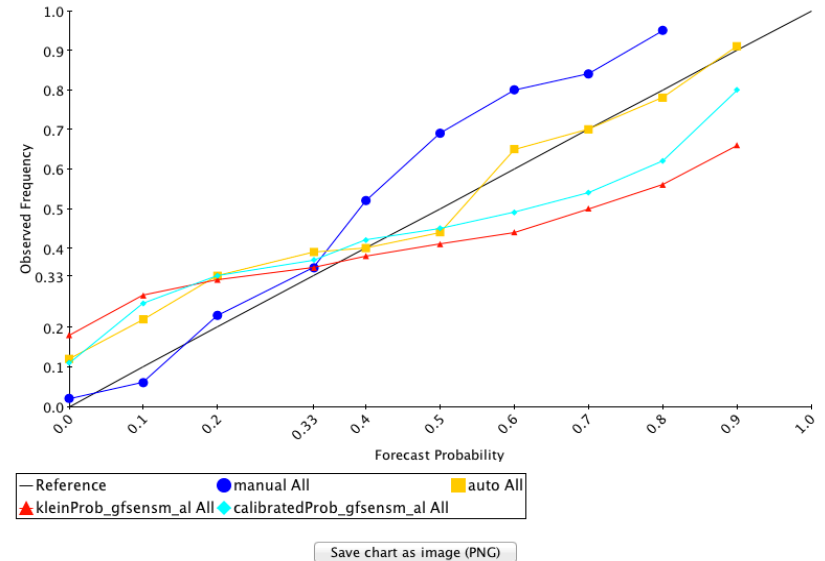
End date [?]

Region(s) [?]

Skill Score [?]

Forecast categories [?]

Reliability Diagram Valid Dates : 01/01/2010 - 06/30/2011



Warnings and Errors

Information

No summary for reliability diagram

How to Read the chart

See the "Tutorial" page (tab at top) for more information.

Interpreting the X-Axis

The values on the x-axis are the *forecast* probabilities.

Interpreting the Y-Axis

The values on the y-axis are the *observed* probabilities.

About the reference line

The reference line represents "perfect forecasts". Values on this line indicate that the forecast probability for a given category matches the percentage of time that category occurred. For example, the point on the line where the x-axis and y-axis values are 0.2 and 0.2, respectively, indicates that forecasts with a probability of 20% were observed 20% of the time. See the "Understanding the skill score" section below for interpreting results based on this line.

Interpreting the Probability Bins

The probabilities are plotted at the value corresponding to the *lower* value of the interval. For example, the interval of probabilities from 0 to 0.1 includes probabilities greater than or equal to 0 and less than 0.1, and probabilities for this bin are plotted at 0. The last interval, 0.9 to 1, includes probabilities greater than or equal to 0.9 and less than or equal to 1, and probabilities for this bin are plotted at 0.9.

Equal chance (EC) forecasts for monthly and seasonal forecasts are included in the scores. For reliability scores including EC forecasts, there is a separate bin from .3333 to .3334 for EC forecasts (only probabilities of .3333 are included in this bin). EC forecasts are scored as forecasts for each



Dynamic POE Web Tool



Dynamic Seasonal Forecast Probability Tool :0



Save Your Results

1 Choose your U.S. climate division

W_Cent_Texas 64

[View Map](#)

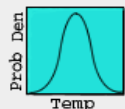
2 Choose your variable

- Temperature
- Precipitation

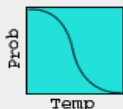
3 Choose your lead time

0.5 Month Outlook for Jul-Aug-Sep 2011

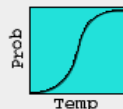
4 Choose the type of graph



PDF: probability density



PoE: probability of exceedance



PoNE: probability of non-exceedance

5 Choose climate info

Past Climate
Standard Reference Period
(Climatology): 1981-210

Forecast Climate

- Observed Data
- CPC Seasonal Forecast
- Curve fit to Observations

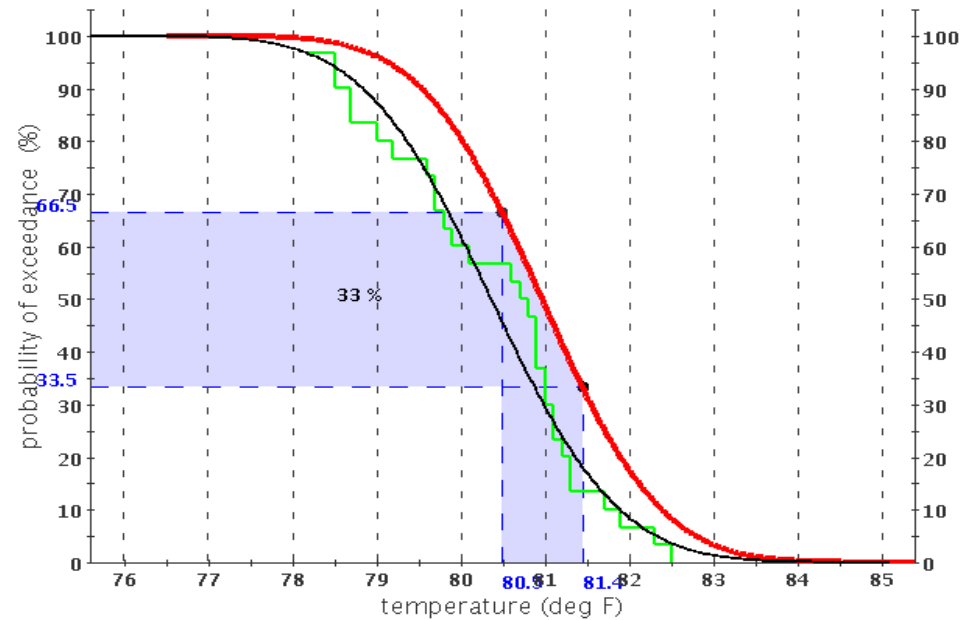
Submit

3 MONTH MEAN TEMPERATURE OUTLOOK

0.5 Month Outlook for Jul-Aug-Sep 2011

Issued Jun 2011

Climate Division W_Cent_Texas 64



— Observed Data — CPC Seasonal Forecast — Curve fit to Observations

6 Customize your graph

Interval analysis lets you focus on information between two values

Select the probability (%) interval:

Select the variable (Temp, Precip) interval:

80.5 to 81.4

3-category (tercile) forecast. Similar to the linked products [\(link1\)](#) [\(link2\)](#)

Threshold analysis lets you focus on information above or below a single value

Forecast Statements

There is a 66.5 % chance that the average seasonal temperature will exceed 80.5 deg F and a 33.5 % chance that it will exceed 81.4 deg F. There is a 33 % chance that it will be within 80.5 deg F and 81.4 deg F.

Comparative Statements

The chance of temperature greater than 80.5 deg F differs by 20.7 % from the probability based on the observed climatological reference period, and the chance of it greater than 81.4 deg F differs by 15.2 %.

Lessons Learned, Future Implications

- R2O is naturally difficult but having protocols in place improves process
- Collaborative development, project planning, version control, Issue-tracking, and wiki usage enables efficient development.
- These tools are being increasingly incorporated into CPC's Operations Branch, and have permanently changed our mode of day-to-day operations.
- VWT and Dynamic POE were successfully developed using the 5 R2O elements.
- CPC/CLIMAS Successes: web services, dynamic process initiation, user interfaces, usage of software development tools, usability testing.
- Other parts of NCEP are adopting these software development techniques (NCO, EMC).
- Collaboration can go beyond development and include implementation.

Questions?Comments?