

**A PROPOSAL FOR METHODOLOGICAL APPROACH TO THE USE OF ANIMATED MAPS INTO A COORDINATED MULTIPLE VIEWS ENVIRONMENT FOR RAINFALL ANALYSIS**

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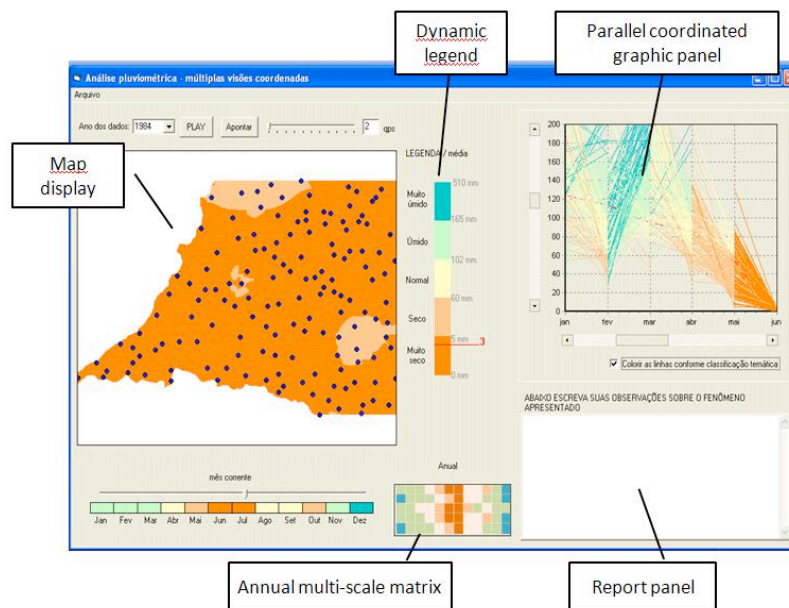
Maps are often used to facilitate the comprehension of spatial information. Particular in climate analysis, the spatial and temporal aspects of a geographic phenomenon must be studied together. The representation of temporal aspect is very challenging once the user needs to perceive the spatial changes through time to recognize “when” something occurs, along with “where”. As a hypothesis, can we reach some improvement using not only animated maps, as also other graphic resources, all connected in an interactive environment?

The analysis of spatiotemporal information usually requires not only a set of static independent presentations of the temporal and spatial aspects, but it also requires the visualization tools to handle interactively these presentations and to facilitate analytical reasoning process. Coordinated Multiple Views (CMV) is a technique of data exploratory visualization in which the data are presented in different graphic representation, each one in a different view, and everything must be synchronized. This technique was developed for the investigation of complex data, which need to be analyzed in several views for information comparison, aggregation or incorporation in different ways at the same time.

Therefore, this paper aims to present a methodological approach to analyze the role of animated maps in a CMV environment. The intent is to evaluate if the animated maps can speed up the process of new knowledge acquirement in the analysis of climate phenomena. As case study, it has been used the rainfall data of western region from São Paulo State in Brazil.

The study is divided in two stages: 1 (finished). Cartographic design and project, that included the user needs analysis (climatology researchers and experts), rainfall data acquisition and edition, test groups definition and implementation of test interface; 2 (current activity) Tests and analysis, including the application test and evaluation (interview, interface’s use record and results of user analysis of data).

The interface for tests (Figure 1) contains three different coordinated views (animated map, parallel coordinated graphic and multi-scale matrix), control animation buttons, and a report panel. All the views are related to a unique data source, that is, the shapefile of rainfall stations with its attributes.



*Figure 1 Interface for test*

The animated map panel contains a map display and a dynamic legend. The dynamic legend is a scaled bar with a pointer that shows the rainfall monthly mean, so it moves up and down, along the bar, pointing to the position in the scale that represents the monthly mean value. The monthly multi-scale matrix (bellow

the map) where the lines represent different years and the columns represents the months, colored according the classification adopted. There is also a pointer that shows the month presented at the moment. The parallel coordinated graphic panel (at the upper right part of the interface) shows the behavior over time of each rain collection station depicted on the map. Each line represents one rainfall station and describes the classification of the station from one month to the next. The scrolls change the interval of rain in millimeters (vertical scroll) and the interval of time (horizontal scroll) that will be presented.

With the aim to analyze the effectiveness of animated maps as part of CMV, it was defined a group of climate researchers and experts, that will use the test interface with and without the animated maps. The interviewed subjects should perform the following:

1. Answer questions about personal and research work characteristics, this data will be used to define the personal aspects of each individual
2. Listen and pay attention to the instruction about how to perform the test and use the interface, it will be applied the direct conversation verbal report, in which the interviewed one has to describe the steps that can be followed to complete the general task.
3. Perform the general task: "Analyzing the rainfall data presented, please describe your observations about the phenomenon behavior and the tools that helped you to visualize that". All observations will be registered by the volunteer in a reserved space of the test interface (report panel).

All the interactions performed by the volunteer will be registered in a log report, including the mouse-down actions, the time spent, the tools used, the changes in the interface, and the eyes movement, registered by a webcam applied to the computer. The intention is to discovery subjective preferences and behavior patterns.

One group will use the interface with animated maps that can be controlled with play and pause buttons. The second group will not use animation, although they will use static maps created for each month. And a third group will use the interface with no map at all, only the graphic information.

It will be analyzed the records collected from these tests, as well the personal information obtained from the interview and the logging report from the use of interface. With this analysis we intent to be able to answer the following questions:

- Are the geographic phenomena better understood with animated map than static map? If it is, when the animated map is needed to better comprehension of the phenomenon?
- Do the use of maps in CMV promote a more fast and effective visualization of rainfall analysis?
- Are the personal observations and conclusions of volunteers mostly related to the personal experience? Or can the CMV offer the support needed for visualization of rainfall data despite the personal characteristics?

These questions can help us to understanding when the use of maps (animated or not) must be considered as part of the CMV to facilitate rainfall analysis