Database of Weather Charts for Hundred Years: Construction of long-term data archives on weather charts created by Japan Meteorological Agency

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Weather charts are valuable resources to represent the history of meteorological observations in Japan because of their importance on understanding and prediction of weather based on the integration and visualization of meteorological observations on the ground and in the upper atmosphere. We started the construction of a long-term data archives for weather charts that have been created by Japan Meteorological Agency (JMA) and its predecessors since March 1, 1883 for about 134 years, and released a website called “Database of Weather Maps for Hundred Years” (http://agora.ex.nii.ac.jp/digital-typhoon/weather-chart/).

The core part of this database is weather charts purchased from Japan Meteorological Business Support Center. Weather charts were uniformly extracted and converted so that they can be searched by date. Continuous from the beginning is the surface weather chart around Japan or Asia Pacific, and the type of weather charts has been gradually increasing to reach eight at the latest. In general it can be considered as continuous time series, but weather charts are significantly missing for twenty days in September 1923, which seems to be the result of fire at the Central Meteorological Observatory in Tokyo after Great Kanto Earthquake on September 1. The website was publicly released on November 2015, after an experimental release on January 2014 with a credit stating that this database is based on the usage of data from JMA according to the data policy of JMA.

The original plan was to construct the database of weather charts that are geometrically corrected (georeferenced). The manual geometric correction of weather charts is infeasible for more than 100,000 weather charts, so the key is the development of an automated process for the geometric correction. As a result, weather charts after August 1958 could be processed to a satisfactory level, so we took advantage of geo-browsers such as Google Earth, Google Maps and Cesium to show the overlay of georeferenced weather charts.

The next challenge is to improve the usability of the database. Search by date was the first search method being implemented, but more advanced search methods were missing due to the lack of metadata. Hence we implemented four methods to improve the findability of weather charts. First, we added search for the description of “daily weather charts” from JMA to enable keyword search on relevant weather phenomena. Second, we integrated with other databases of “Digital Typhoon,” to provide a variety of access methods such as weather charts of the day of typhoon landfalls, or weather charts of the day of disasters that satisfy a set of criteria. Third, we created short narratives on relevant weather charts with the help of NPO Weather Caster Network to access weather charts of historical events and extreme observations (29 cases) or major typhoons (19 cases) through the narrative of weather charts. Fourth, we used an image browser with synchronized timelines called “SyncReel,” to offer efficient access to past weather charts by scrolling horizontal timelines.

A challenge for the future is the mining of information embedded within weather charts. Automatic extraction by software does not work for weather charts on which lines are written multiple times. Instead, we should rely on the power of human through the activity of crowd-sourcing or citizen science, where scientists and citizens can take part in the activity of information extraction from weather charts after considering the following issues. First, we need training for the proper interpretation of data such as different unit of pressure. Second, we need to clarify contribution

to science about how historical weather charts can contribute to scientific discovery, because this is where citizens are motivated to contribute to the activity.

Keywords: weather chart, database, geometric correction, georeference, historical resource, citizen science

