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RECOGNITION OF SIX-HOURLY GLOBAL MAPS OF ICE, TEMPERATURE AND CLOUDS - REAL-TIME AND 10-YEAR ARCHIVE

CARTER J.(1), KOHRS R.(2)

(1) Illinois State University, NORMAL, UNITED STATES ; (2) University or Wisconsin, MADISON, UNITED STATES

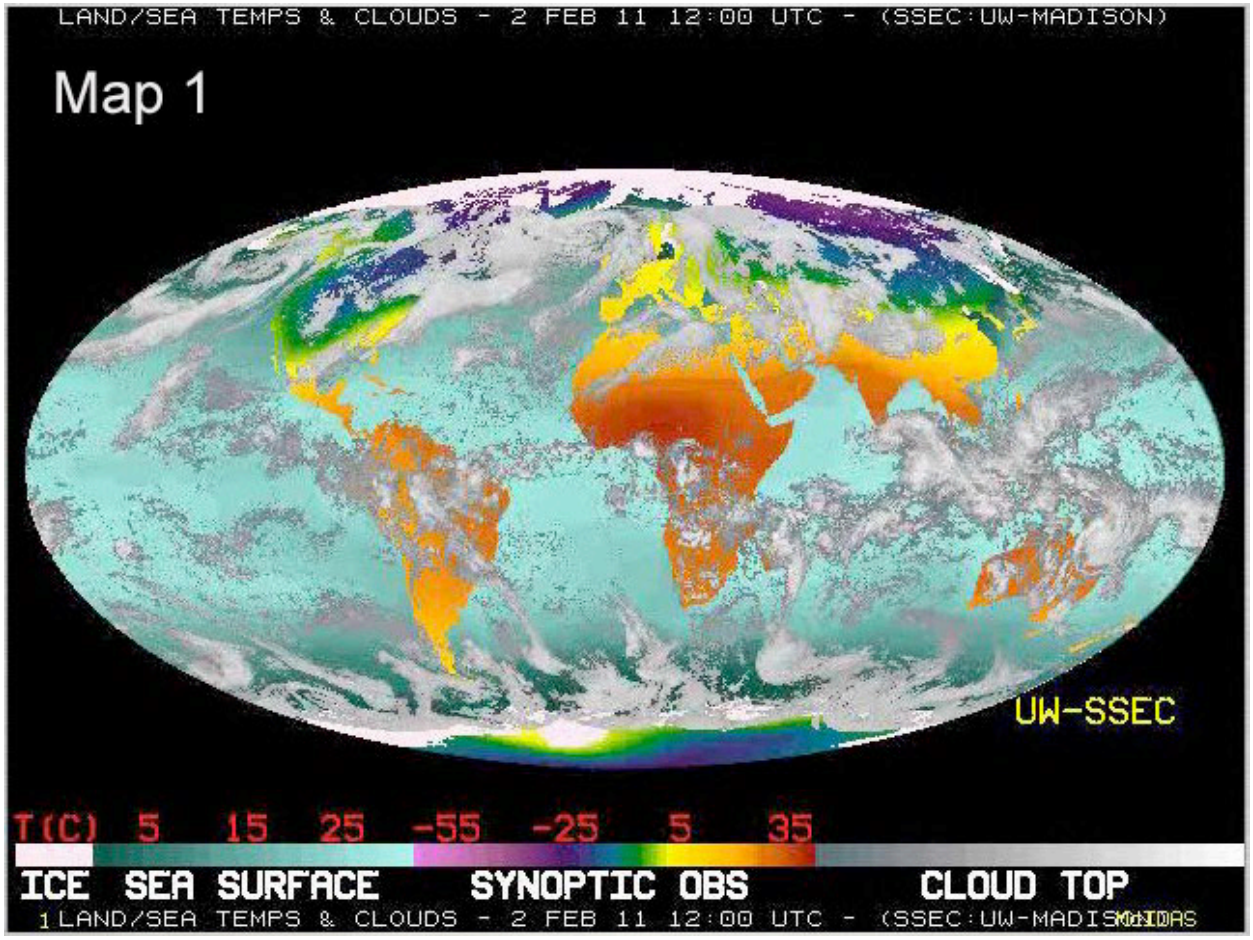
For more than a decade the Space Science Engineering Center at the University of Wisconsin has posted six-hourly Global Montage maps on the web depicting cloud top and land/sea temperature along with sea ice At the same interval an animated sequence of 40 maps covering a ten day period are posted in MPEG and HTML formats. http://www.ssec.wisc.edu/data/composites.html

This Global Montage is a composite of satellite data, weather observations and model outputs portrayed on the equal area Mollweide Projection. The image with legend is 640 X 480 pixels, giving a resolution of about 35 km. Thus, the maps show synoptic scale phenomena and larger.

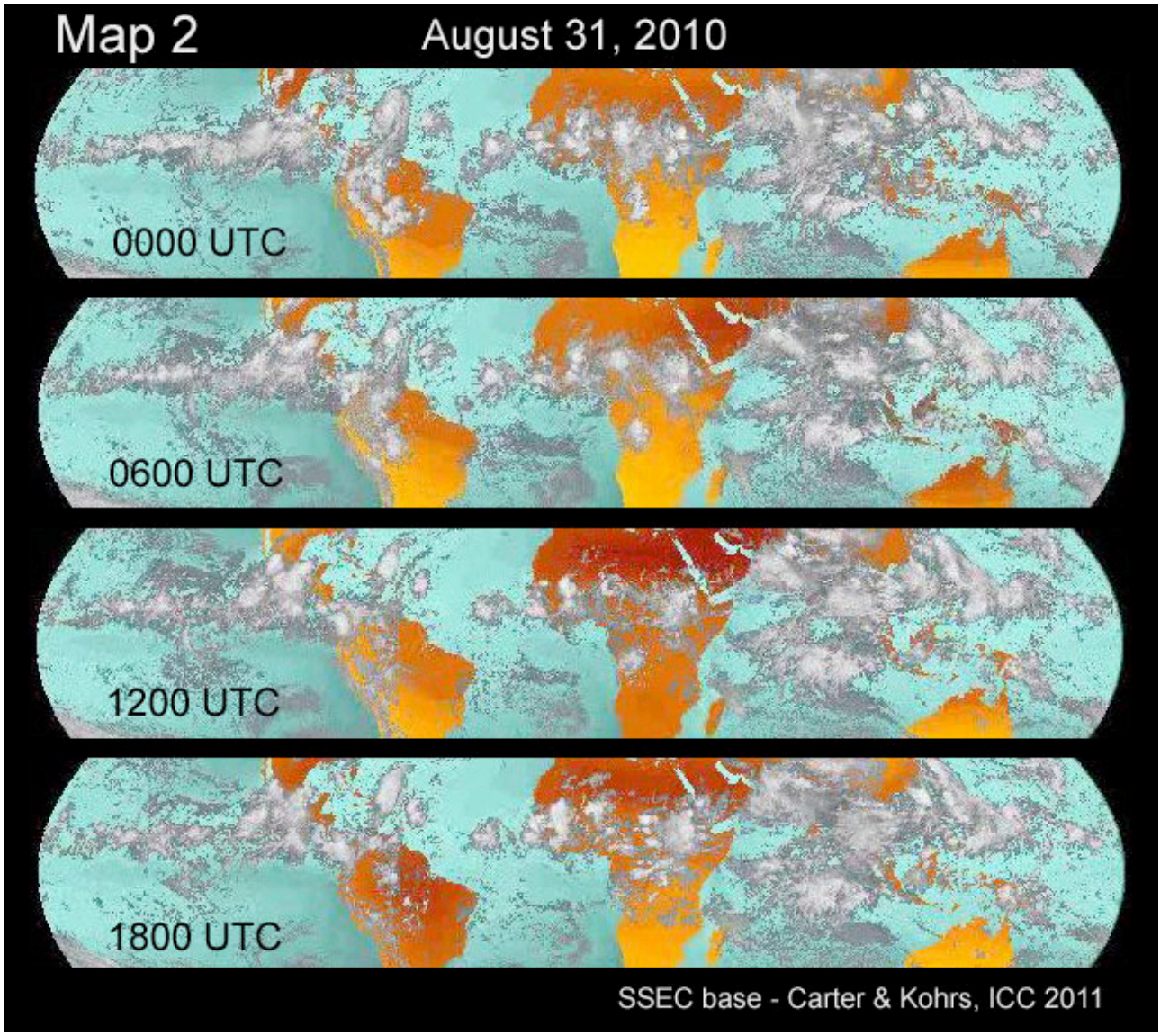
This cartographic product has utility for education, both for the climate/weather content and as a map literacy tool. Because much of the content of these maps will not be evident to first-time viewers, attention is given to ways to introduce the maps to students and teachers.

There are three basic types of map portrayals with these products.

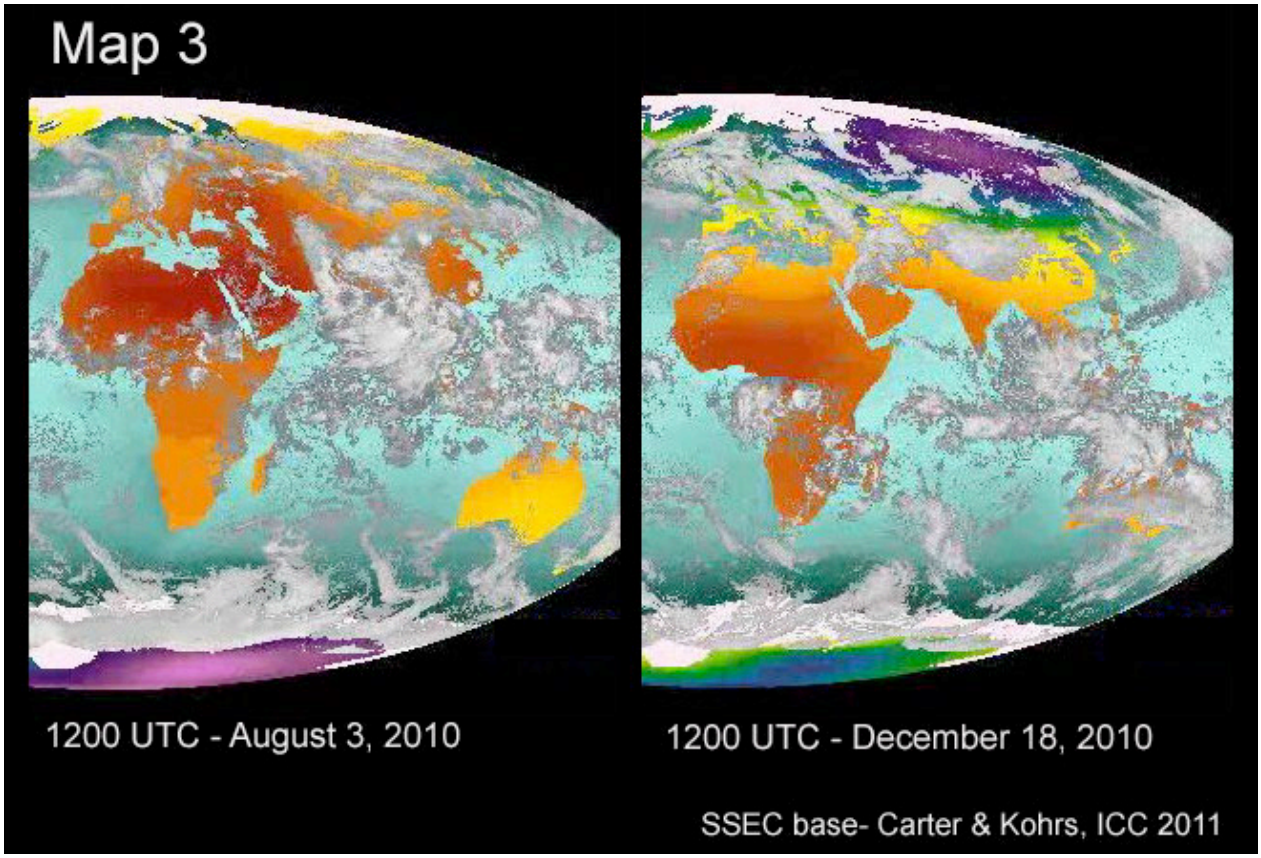
1 – An individual map showing temperatures of the land and water, presence of sea ice, and the pattern of cloud systems around the world. Map 1



2 – A sequence of maps at six hour intervals, showing how temperatures of land and water vary throughout the day and the development, movement, and decay of weather systems. Map 2 replicates a portion of an animated sequence.



3 – By comparing individual maps or sequences of maps at distinctly different times of the year climatic patterns can be seen. Map 3 shows portions of two maps, both at 1200 UTC. The August 3 map is representative of the Northern Hemisphere summer and the December 18 map is representative of the Southern Hemisphere summer.



Introducing the map products

The spherical earth is portrayed on the equator-centered Mollweide Projection, which is equal area but has significant shape distortion along the edges. Many weather maps are on rectangular projections so it is important to ascertain that the viewer is comfortable with the image of the continents and oceans on this projection. Formal instruction on basic map projections has been employed before introducing these maps.

The symbolization employed on these maps consists of four distinct color combinations. The colors and shades used are arranged in a single bar legend. Map 1

A light pink indicates sea ice, a nominal class with no variation in tint.

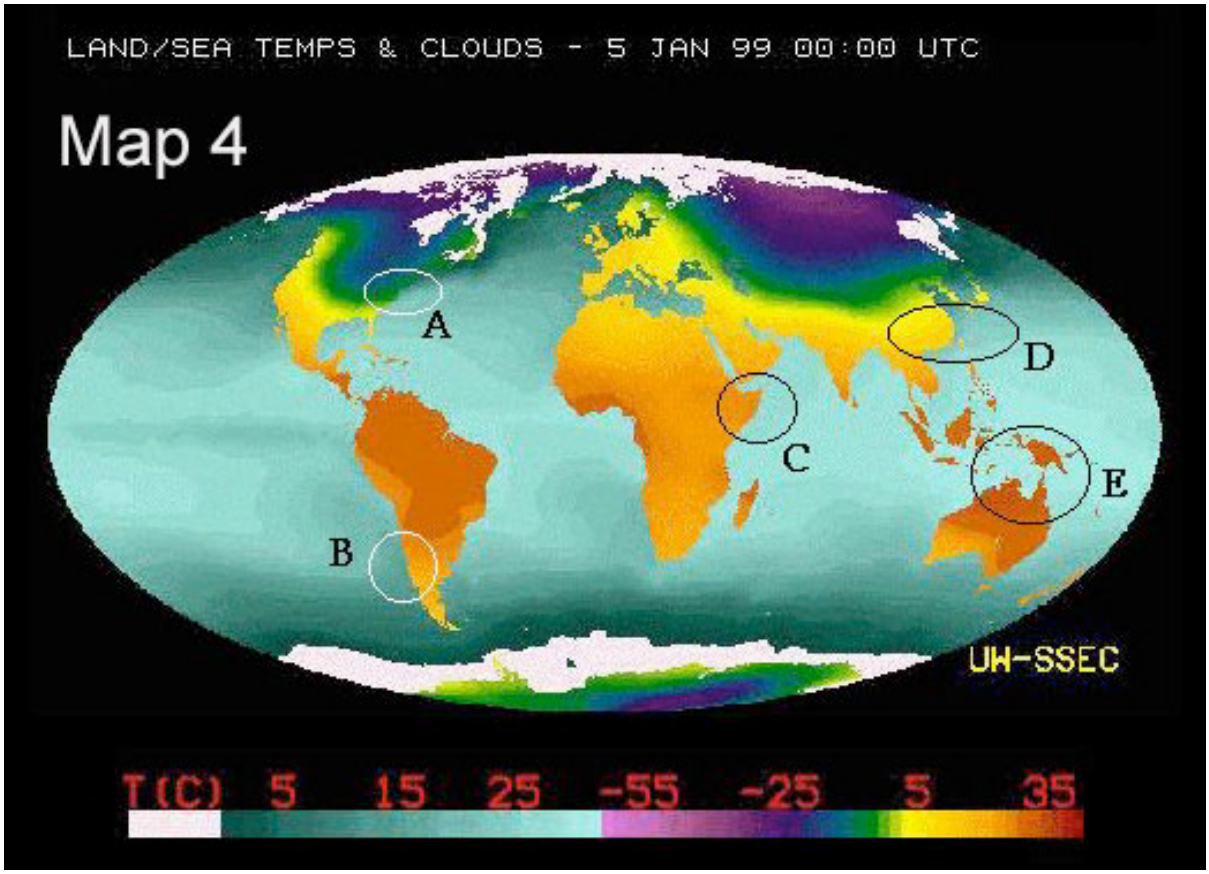
A gradation in value of aqua symbolizes the temperatures of water surfaces. Values of 5, 15 and 25 degrees C are labeled, in 10 degree increments. Water surface temperatures range from about 0 to more than 30 degrees.

A series of hues ranging from a purple through blue, green, yellow, orange and red represent the temperatures of the land surface. The total range of temperature goes from about -60 to 40 degree C, with values given in 30 degree C increments at -55, -25, 5, 35.

Note that the range of temperatures over land is far greater than the range over water, which illustrates an important climate control factor. If viewers understand the logic of this legend, they have learned much about weather, climate and map reading.

Overlaid on top of this multi-color map base is cloud imagery, which obscures the temperature information where clouds are present. The cloud cover is portrayed in a gray-to-white gradation with the lightest gray assigned to the coldest clouds, signifying the highest clouds. No temperature values are assigned to cloud shadings. In developing this cloud overlay a new algorithm was developed to better identify cloud free regions by using temperature differences between cloud tops and the surface. http://www.ilstu.edu/~jrcarter/SSEC/

To introduce these maps, a single base map has been used which does not have the black/white cloud overlay. Map 4



Many variations of this map were created to pose different questions in an online instructional program. http://www.ilstu.edu/~jrcarter/SSEC/ In this example students were asked to demonstrate their ability to relate colors on the map to values in the legend. They should be able to determine that the water at D is warmer than the land.

A Sample of Content on the Maps

Map 1 is a single image of 2 February 2011, 1200 UTC, selected because it shows two unique situations: Cyclone Yasi over NE Australia and a very cold North America with freezing temperatures extending into Mexico. The purples of the Arctic contrast with the warmer blues of the Antarctic. The arcuate cloud patterns of the middle latitudes stand in contrast to the less organized patches of clouds in the tropics. Note the clockwise rotation of mid-latitude storms in the Southern Hemisphere and the counter-clockwise rotations in the Northern Hemisphere.

Map 2 consists of 4 sequential images in one day showing how animated maps portray the diurnal march of temperatures from east to west as well as the development, movement and decay of storms. Note the series of tropical storms moving from central Africa into the Atlantic. On the animated sequences the strong west to east motion of the extratropical cyclones stand in contrast to the tendency of tropical systems to slowly migrate from east to west.

Map 3 has portions of two maps, both at 1200 UTC, showing the seasonal shift of the ITCZ and the resulting monsoons. The August 3 map shows a cloud-free Australia and a cloudy south Asia, while the December 18 map shows a clear south Asia but heavy clouds over Australia. These patterns help explain the floods of Pakistan in summer 2010 and the floods of Queensland in early 2011. These two images also show the seasonal gain and loss of ice at the poles and the temperature extremes. By contrast the equatorial areas are uniformly warm on both maps and Indonesia is hidden by clouds in both seasons.

The Challenge

These maps have great educational value, in terms of weather, climate and map literacy. Effort needs to be focused on informing educators about these maps and ways to present them to uniformed viewers.