

**Krisztián Kerkovits – János Györffy – Mátyás Gede**

## **Renewing Cahill's equal-area butterfly projection**

### *Abstract*

Today, as computer-assisted cartography is getting more popular, maps are usually created from databases or other digital data formats. Exact formulas of projections are needed to be known to create programs that can handle them. Heuristic or graphically described, old projections may be brought up and be renewed for digital applications.

English cartographer B. J. S. Cahill made three variants of butterfly maps in the beginning of the 20<sup>th</sup> century. Although they had low distortions and looked really aesthetic, these maps were not popular due to their complexity. Furthermore, one of the three variants – the equal-area map – had no mathematical projection formulas.

Due to these reasons we decided to renew this projection. Our aim was to create a new projection by using exact mathematical formulas to approximate the original map. The primary goal is to have a projection of similar appearance, while it does not have to be equal-area at every points of the map, as Cahill's butterfly is also not truly equal-area because of the manual distortions. However, we wanted to keep area distortions low. Additionally, all graticule lines have to be smooth.

We developed two solutions: The first one is an orthogonal variant, using the Albers equal-area conic projection in the temperate latitudes and the modified orthogonal polyconic projection in polar regions and tropic zones. The second one is also an equal-area projection using Bonne equal-area pseudoconic projection around the poles, and a modified equal-area polyconic one near the Equator.

A JavaScript implementation of the projections was also developed to facilitate their use in webcartographic applications. Its practical use is illustrated by a sample web page using the OpenLayers framework.