Geophysical Research Abstracts
Vol. 15, EGU2013-10240, 2013
EGU General Assembly 2013

Generating geomorphological catalogues using neural networks: Seamounts in the Atlantic Ocean

Andrew Valentine (1), Lara Kalnins (2), Chantal van Dinther (1), and Jeannot Trampert (1)

(1) Department of Earth Sciences, Universiteit Utrecht, Utrecht, Netherlands, (2) Department of Earth Sciences, University of Oxford, Oxford, UK

We recently introduced the idea that neural networks may be used to construct catalogues of geomorphological features, by extrapolating from the characteristics of a set of hand-selected examples (Valentine *et al.*, 2012). These learning algorithms are inspired by the complex pattern identification and recognition capabilities of the human brain and remove the need to develop an *a priori* model of the feature of interest.

In order to demonstrate this approach, and to develop a clearer understanding of its possibilities and pitfalls, we concentrate on the problem of identifying seamounts — isolated topographic highs of volcanic origin — in the world's oceans. The distribution of seamounts in time and space can provide important constraints on the tectonic history and evolution of the Earth and has been studied using several conventional approaches (e.g. Kim & Wessel, 2011). However, these typically perform poorly in the Atlantic, where the slow spreading rate results in a rough 'background' seafloor that produces many false positives. The learning algorithm approach should improve this, as it attempts to encapsulate more complex information about the seamount and its surroundings.

We present an overview of our work to date, with a focus on results from a systematic search for seamounts in the Atlantic. We compare the performance of our approach in detecting seamounts in bathymetric, free-air gravity anomaly and vertical gravity gradient (VGG) datasets to examine the particular strengths and weaknesses of each data type and to assess the potential benefits of assimilating information from two or three data types simultaneously. We compare the resulting seamount database with existing catalogues, examining the variations in measures such as total count, height distribution, and spatial and temporal distribution across the Atlantic, and comment on the potential implications for our understanding of the tectonic history of the region.

Kim, S.-S. & Wessel, P., 2011. New global seamount census from altimetry-derived gravity data, *Geophysical Journal International*, 186, pp.615–631.

Valentine, A., Kalnins, L. & Trampert, J., 2012. Hunting for seamounts using neural networks: learning algorithms for geomorphic studies, *EGU General Assembly*, Abstract EGU2012-4560.

Valentine, A. & Trampert, J., 2012. Data-space reduction, quality assessment and searching of seismograms: Autoencoder networks for waveform data. *Geophysical Journal International*, 189, pp.1183–1201.