A comparison of satellite data filtering techniques to improve global magnetic field models

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With the launch of Orsted in 1999 and Champ in 2001, we now have a satellite magnetic data set apparently remarkably well distributed in space, in comparison with the data available from earlier epochs. However when data are selected from these data sets for global field modelling, for example by using the traditional approach of night and/or quiet time data only, the distribution is not as homogeneous as one might have expected. We therefore investigate how different selection techniques improve the quality of recent magnetic field models, particularly focusing on the use of appropriate magnetic indices at high latitudes, for example the Image magnetometer array index IE and the polar cap index PC. We also study the effect of releasing the selection constraints in order to improve the spatial coverage, using vector satellite data over the polar caps, and selecting data relative to a pre-defined model, which may contain its own biases and other errors. We demonstrate the impact of these various options by generating geomagnetic field models of up to degree 40. From a simple comparison of the respective power spectra we get a good indication of the effectiveness of the various selection techniques in terms of minimizing spectral noise. The overall results indicate that having properly weighted noisy data is better than selecting data for very quiet times only