



Is the atmosphere interesting? A projection pursuit study

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The Northern hemisphere winter circulation is probed for deviations from Gaussianity. A projection pursuit approach is applied that search for directions in phase space that maximise an index of interest. Different indices gauging different aspects of non-Gaussianity such as flatness, bimodality, and unimodality are considered. The projection pursuit approach allows high-dimensional data spaces to be investigated and it therefore complements previous studies that usually have been confined to spaces of a few dimensions. Both the stratospheric and tropospheric circulation are studied as well as daily, monthly, and annual time scales.

The statistical significance of the results is considered by a Monte Carlo method where results from the atmospheric data are compared with results from Gaussian distributed surrogate data. The surrogate data are generated so that they have the same temporal structure (memory) as the original data. Careful considerations of the statistical significance are of particular importance in studies with exploratory methods such as projection pursuit.

In the stratosphere we confirm the moderate evidence for bimodality in the inter-annual variability of extended winter means. On monthly and daily time scales we find strong evidence for non-Gaussianity but no evidence for bi- or multi-modality. In the troposphere only evidence for non-Gaussianity is found.

The geographical patterns related to the directions of maximum interest are studied and their relations to known teleconnection patterns investigated.