CLUSTER ANALYSIS OF MARTIAN ATMOSPHERIC TEMPERATURE PROFILES. G. A. Marzo[1], M. A. Lopez-Valverde[2] and F. Gonzales-Galindo[2], [1]NASA Ames Research Center, Space Science and Astrobiology Division, Moffett Field, CA, USA, Giuseppe.A.Marzo@nasa.gov, [2]Instituto de Astrofisica de Andalucia, CSIC, Granada, Spain, [3]Laboratoire de Météorologie Dynamique, CNRS, Paris, France.

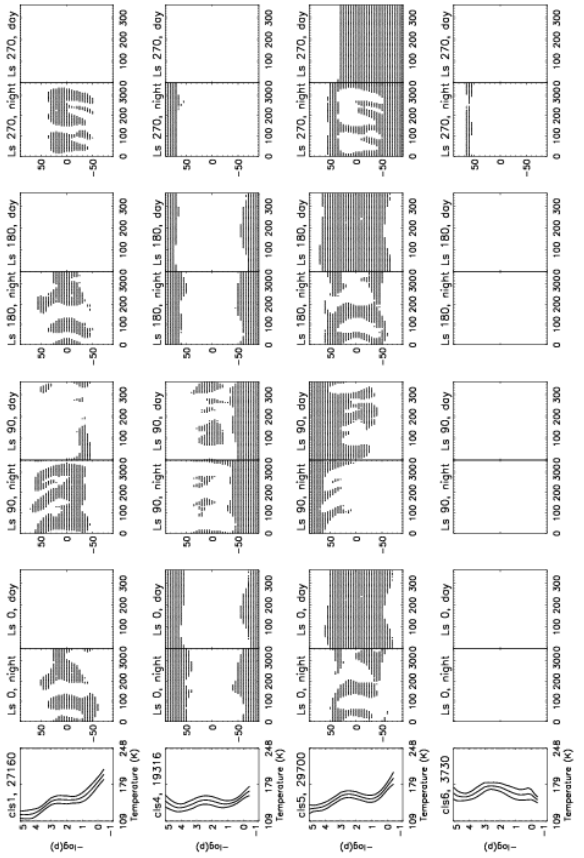
Introduction: Cluster analysis a powerful tool to reduce a large amount of multivariate data to a few representative cases. Its most obvious application is to large data sets, such as spectroscopic remote sensing measurements of recent space experiments, as well as, cases where a huge amount of information needs to be explored in order to understand its scientific content. Marzo et al. [1] presented an unsupervised statistical clustering scheme able to reduce a spectral data set to a few clusters allowing for more focused, and rapid, evaluation of their scientific meaning.

Reference climatologies, ideally based on validated measurements, are useful research tools for remote sensing and multiple theoretical modeling studies. Some efforts [2] to update the first COSPAR Mars International Reference Atmosphere [3], combine recent measurements from space with the two most common databases, the Mars-GRAM [4] and the ESA Martian Climate Database (MCD) [5,6].

Goal of the work: In this work we apply clustering to pressure-temperature profiles of the MCD with the dual goals of (i) building a simplified reference climatology for Mars from the surface to the exosphere, and (ii) evaluating trends and potential biases in the current MCD, specially at mesospheric and thermospheric altitudes, where the lack of data is more severe.

In this work we assess the criteria to identify natural clusters in the MCD, and estimate their associated uncertainties. We also interpret the scientific meaning of the cluster representatives obtained, based on comparisons with MGS/TES and the MCD itself, and propose to use this technique to other/future data sets such as regular mapping with MRO/MCS.

Preliminary results: Here we provide an example of clustering. We extract from each MCD scenario the temperature profile (from the surface to the thermosphere) for each node of a 5°×5° resolution grid covering all of Mars. This procedure was repeated twice; for 2h and 14h local time. This allows us to evaluate differences between night and day. After assessing the criteria to identify natural clusters, we identified nine clusters. In the first column of the figure we report the cluster averages and standard deviations for the case of scenario 8 of the MCD (i.e. cold, low dust, low solar activity). The number of profiles included in each cluster is reported. In the other columns, we show the geographical distribution (latitude vs east longitude) of the clusters, for different seasons (Ls = 0°,90°,180°,270°) and local time. This case shows that only four clusters (1,4,5, and 6) are enough to represent scenario 8. In particular, cluster 4 occurs at the poles almost throughout the year, while cluster 5 appears to be representative of the major portion of the planet during the year. Cluster 1 occurs in some specific regions across the equator during day time, while cluster 6 represents the very specific case of a narrow sub-polar region in winter time. The other clusters obtained (not reported here) mainly occur for different scenarios, such as a warmer atmosphere and/or different combination of atmospheric dust content and solar activity.



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