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Modeling total solar irradiance variations using automated pattern recognition software

Daryl Parker

Department of Physics and Astronomy, University of California, Los Angeles 90095

Roger K. Ulrich

Department of Physics and Astronomy, University of California, Los Angeles 90095

Luca Bertello

Department of Physics and Astronomy, University of California, Los Angeles 90095

John E. Boyden

Department of Physics and Astronomy, University of California, Los Angeles 90095

Judit M. Pap

University of Maryland Baltimore County/NASA Goddard Space Flight Center, Greenbelt, MD 20771

Abstract. This poster presents the results of using the AutoClasssoftware, a Bayesian finite mixturemodel based pattern recognition program developed by Cheeseman and Stutz (1996), on Mount Wilson Solar Observatory (MWO) intensity and magnetogram images to identify spatially resolved areas on the solar surface associated with TSI emissions. Using indices based on the resolved patterns identified by AutoClass from MWO images, and a linear regression fit of those indices to satellite observations of TSI from the Virgo instrument, we were able to model the Virgo observations from the MWO data with a correlation of better than 0.96 for the period 1996 to 2007.
The association of the spatial surface regional patterns identified by AutoClass with the indices developed from them also allows construction of spatially resolved images of the Sun as it would be "seen" by TSI measuring instruments like Virgo if they were able to capture resolved images. This approach holds out the possibility of creating an on-going, accurate, independent estimate of TSI variations from ground based observations which could be used to compare, and identify the sources of disagreement among, TSI observations from the various satellite instruments and to fill in gaps in the satellite record. Further, the spatial resolution of these "images should assist in identifying with greater accuracy the particular solar surface regions associated with TSI variations. Also, since the particular set of MWO data on which this analysis is based is available on a daily basis back to at least 1985, and on an intermittent basis before then, it may be possible to construct an independent estimate of TSI emission at several solar minima to ascertain if there has been any significant increase or decrease, a topic of significance to determining what part, if any, solar TSI variations play

in global warming. The AutoClass program will also be applied to HINODE observations.