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COCOMAG: color-coded magnetograms as probes of active region evolution and complexity

We are proposing a visualization of vector magnetograms whereby the three components of the photospheric magnetic field vector are combined into RGB colored maps, creating color-coded magnetograms (COCO-MAGs). In this configuration the primary and secondary colors represent magnetic field with different orientation. The areas occupied by different color hues are extracted, creating appropriate time series (color curves). The resulting colored maps and color curves are used as proxies of the active region evolution and its complexity. The morphology exhibited in COCOMAGs is associated to typical features of active regions, such as sunspots, plages, and sheared polarity inversion lines. In complex regions, extended, twisted flux systems appear as continuous, color processions, while abrupt color changes signify sheared polarity inversion lines. Active regions in their decay phase are dominated by rather vertical magnetic field (pixels with green color), indicating a gradual relaxation of the magnetic field configuration. The color curves, which represent the area coverage of magnetic field with different orientation, exhibit varying degree of correlation with active region complexity. Particularly the red and magenta color curves, which represent strong, purely horizontal magnetic field, seem to be good indicators of future flaring activity. The proposed visualization can be adapted to different color tables, it facilitates a comprehensive view of the evolution of active regions and their complexity and offers a framework for pattern recognition, feature extraction and flare prediction schemes.

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