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Automatic Cloud-Coverage Evaluation by a Ground Based, Total-Sky Camera

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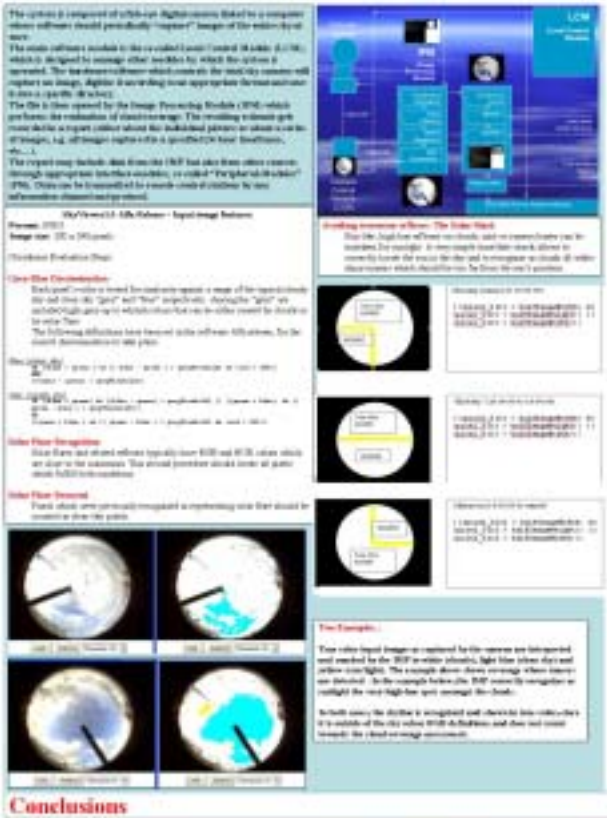
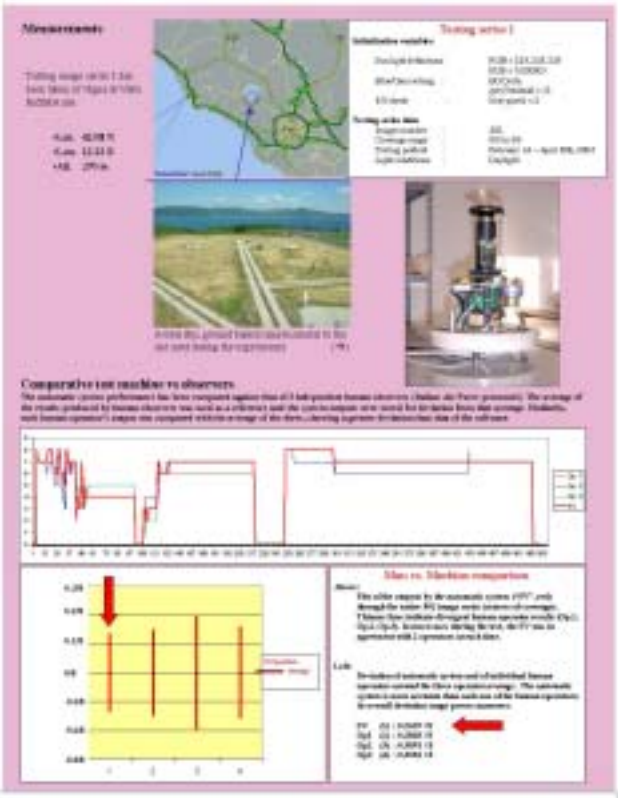
Introduction

We have developed an image-processing procedure to obtain an automatic cloud-coverage evaluation. Images to be analyzed are captured by a ground-based digital camera, equipped with fish-eye lenses. The images are in the visible-light spectrum; the cloud-coverage evaluation is performed taking into account RGB and Hue parameters. By setting appropriate RGB values the algorithm provides for the discrimination of different colors, separating typical cloud palettes from those of the clear-sky. When a solar flare is present in the picture, it can be recognized and isolated by setting an appropriate Hue demarcation value.
This algorithm has been implemented in a JAVA program, which was then tested against a series of 502 images. The program output, expressed in octaves of coverage, was verified by comparison with cloud coverage evaluations made by three, independent human observers on the same images set. The automatic system accuracy proved higher than the human operators' one throughout the entire image series.

Method



Results



Conclusions

The purpose of the experiment was to verify the feasibility of an automatic cloud-coverage evaluation system which could replace a human operator for continuous observations in marginal environments. Such a system could have several applications in meteorology and in environmental sciences as well: a measure of cloud coverage could indeed be correlated with solar radiation assessment in local area exposition analyses. The tested device can be coupled with traditional instruments, either as a stand-alone system or as part of a wider network, for wider-area-data-processing.
The performed tests have shown that not only the system itself is feasible, but also that it can be more reliable, under normal conditions, than standard routine observations made by operators.