Search for Astronomical Sites in Developing Countries and their Preventive Protection

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Abstract. The archives of meteorological satellites permit to find around the world dry sites well adapted to astronomical observations (in the visible, IR and millimetric ranges), as a pre-selection of sites. The GSM (Grating Scale Monitor) technique permits to qualify some of them as astronomical sites for a future setting-up of astronomical observatories. Such sites are found in new astronomical countries or in Developing Countries. At the same time, their preventive protection from light pollution and/or radio interference has to be viewed.

In practice, once the pre-selection is made, the governments of these countries ought to be alerted for example by IAU and/or UN Office for Outer Space Affairs. The local site testing through GSM should be carried out in cooperation with astronomers or scientists of these countries under the umbrella of IAU. This should be an approach to help to introduce astronomy and astrophysics in Developing Countries.

1. Introduction

The knowledge of short time-scale variation stars has made some progress due to campaigns of non-stop observations with simple manual telescopes and photometers, conducted simultaneously around the world. During the last two decades, the automation of telescopes (remote-controlled or robotic telescopes) opened the way to study the variability in the entire HR diagram (e.g. Henry, 1999) and mainly at places where simultaneous variations of different characteristic times from hours to years are discovered (AGB, RGB stars, etc.). To follow these permanent or non-permanent variations during months or years, and to understand their origin, networks of robotic telescopes seem to be nowadays the most appropriate technology.

The first discoveries of the visible counterparts of gamma-ray bursts and of many new NEO demonstrate that the networks of robotic telescopes are/will be powerful in many scientific fields (e.g. ROBONET, GNAT, TORUS, NORT, etc., as described in Querci and Querci, 1999). Consequently, sites for networks have to be implemented on various longitudes (continents) and in the two hemispheres. Excellent sites (Hawaii, North of Chile, South Pole, etc.) or some very good ones (Canary Islands, South Africa, India, Uzbekistan, etc.) are already at work. Are we sure that other excellent sites do not exist elsewhere? In Developing Countries (hereafter DCs) for example?
Astronomy and Space Science could be a contribution to the development of DCs, as already seen, some decades ago, in Canary Islands, Chile, and so on.

2. A way to Select Sites in DCs

A world-wide preliminary map of mean nebulosity (at 0.55 μm) was obtained from 12-year meteorological archives and with 250 km square meshes (Querci and Querci, 1998a,b).

- A first step should be a cross correlation analysis between a worldwide map of high mountain summits (altitude: 2400-3200 m or more) and a worldwide map of small-mesh meteorological archives (2 to 5 km) on cloudiness, humidity, sand winds and light pollution. It could permit to obtain 20 to 30 new meteorological excellent and/or very good sites adapted to optical, IR, or millimetric observations.

- A second step should be a detailed analysis of the local atmospheric turbulence for these 20 to 30 pre-selected sites by a seeing-monitor or by a grating scale-monitor (G.S.M.) technique (Martin et al., 1994). The registration of the parameters L0, the wavefront outer scale, r0, the Fried parameter, τ, the speckle lifetime, and of the isoplanetism angle for each of these sites should permit to select finally 8 to 10 sites besides those already classified as high quality observing sites.

- A third step should be the development of the cooperation and the analysis of the local facilities to implement and to maintain robotic telescopes and their equipment.

The two last steps could be a way to introduce Astronomy and Space Science in DCs through robotic equipment and the analysis of variable objects supported by hydrodynamical calculations.

Preliminary works on large meshes are in progress in many countries. Moreover, analysis with small meshes are in progress on High Atlas (Morocco) and on Lebanese border mountains (Syria)(private communication).

3. A Protection for the Selected Sites

In many DCs, Astronomy and Space Science are not developed at all, and the search for sites is ignored. Consequently, potential sites might be polluted and lost for science in the future.

In a few DCs, collaboration with astronomically-developed countries are under progress. So, the site prospecting and the preventive site protection are now taken into account by national scientific authorities, contributing to the scientific and technical development of the country.
4. Conclusion

The prospecting and the preventive protection of potentially future astronomical sites are very important for Astronomy and Space Science in the next century. These sites of which excellent ones are in DCs, have been suggested from a world-wide mean annual nebulosity map.

We take the opportunity of this IAU/UN symposium for asking the questions: could such a prospecting and preventive protection be promoted

- by each DC individually?
- by some DCs or new astronomical countries grouped together inside regional astronomical organizations such as the Arab Union for Astronomy and Space Science (AUASS)?
- by international astronomical organizations such as European Southern Observatory (ESO), Cerro Tololo Inter-American Observatory (CTIO), etc.?
- by the International Astronomical Union?
- by the UN Office for Outer Space Affairs?

The encouragement and the help of international organizations would be certainly decisive for DCs. At the scientific benefit of themselves as well as of the international community.

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