Site Surveys for the Extremely Large Telescopes and More: Sharing the Experience and the Data

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As the site surveys for the Extremely Large Telescopes are nearing completion, two workshops gathered site testing specialists and atmospheric physicists to discuss the instrumental and data analysis issues. The two workshops are briefly reported.

Figure 1. The participants of the site characterisation workshop in Kislovodsk, Russia grouped in the mountains.

Comprehensive Characterisation of Astronomical Sites

held at Kislovodsk, Russia,
4–9 October 2010

The meeting[1] was organised by the Sternberg Astronomical Institute (SAI) of Moscow University and the IAU Working Group Site Testing Instruments.

This workshop was the opportunity for all teams currently involved in astronomical site testing to gather and share ideas and experience. The meeting place (see Figure 1), chosen by the Sternberg group, is close to Mt. Shatdzhatmaz, chosen after a three-year site survey to host a 2.5-metre telescope currently being built in Europe. The National Astronomical Observatories of China and the Chinese Center for Antarctic Astronomy are investigating the potential of Antarctica (Dome A) and West China (Tibet) for ground-based national projects. The Indian Institute of Astrophysics is investigating high altitude sites (> 4000 metres) in Ladakh for a national project (NLOT). The site survey for the future Iranian National Observatory's 3.4-metre telescope is coming close to completion with the detailed study of the surface layer turbulence at the two shortlisted summits (Qom and Kashan areas) to determine the optimal height above ground of the telescope.

Discussions on the instrumentation illustrated the impressive evolution that has occurred over the past decade. Precipitable water vapour (PWV) monitoring is now a mature technique with a wide suite of instruments (radiosondes, radio, infrared and GPS ground-based monitors). Monitors of the optical turbulence (measured by the structure constant of the atmospheric refractive index C_n^2) have evolved over the last decade: the differential image motion monitor (DIMM) technique has become a standard worldwide and a number of complementary instruments (Multi Aperture Scintillation Sensor [MASS], SLOpe Detection And Ranging [SLODAR], SCIntillation Detection And Ranging [SCIDAR], SLope and scIntillation Detection And Ranging [SLIDAR], LUnar SCIntillometer [LuSCI]) are now available to analyse in detail the turbulence profiles along various sections of the line of sight. More effort is needed however for robotic sky monitoring of cloudiness: currently mostly performed using 1D sensors (visual light meters or infrared sky temperature sensors), while 2D all-sky cameras still rely on visual analysis.

Atmospheric Data from Astronomical Site Testing in Chile

held at Valparaiso, Chile,
1–3 December 2010

The workshop was hosted by Universidad de Valparaíso and jointly sponsored by the TMT Observatory Corporation and ESO[2].

The Astro-meteorology Group of the Physics Department of the University of Valparaiso has accumulated much technical know-how in the use of global and meso-scale meteorological models. As was demonstrated at a previous workshop (Masciadri, 2008) such tools can provide accurate forecasts of observing conditions at ground-based observatories, e.g., as a support to queue scheduling in service observing mode. These models need, however, to be checked, calibrated or tuned against real site data before becoming operational. One of the main drivers for this workshop (the participants are seen in Figure 2) was to present and discuss the data collected by the observatories in Chile.

In the domain of site surveys, the US Thirty Meter Telescope (TMT) project has set the standard with the release of its site testing database to the public shortly after the site decision was taken. Obviously other institutions will follow. However data can be shared and sites can be compared worldwide only when much care has been taken to maintain a high quality standard all through the data collection process. A prerequisite is obviously that different instruments measuring the same parameters should agree. Several cross-comparison issues were discussed in detail, including the measurement of the turbulence in the surface layer, of the wavefront coherence time and of the precipitable water vapour.

Among the positive results of the meetings in Russia and Chile, was the decision to re-assert interest and support in the IAU Site Testing Instruments Working Group activity initiated by A. Tokovinin (CTIO)[3], in particular adding a special section for listing the available database worldwide, which A. Otarola (TMT) has kindly agreed to organise[4].

References

Masciadri, E. 2008, The Messenger, 134, 53

Links

[1] Workshop web page: http://site2010.sai.msu.ru/
[2] Workshop web page: http://www.dfa.uv.cl/sitetestingdata/
[3] IAU Site Testing Instruments Working Group: http://www.ctio.noao.edu/science/iauSite/
[4] Sharing of site testing data: http://project.tmt.org/~aotarola/ST

Figure 2. The participants at the workshop on site testing atmospheric data in Valparaiso, Chile arrayed by the harbour.

ESO's Hidden Treasures Competition

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ESO's Hidden Treasures astrophotography competition gave amateur astronomers the opportunity to search ESO's Science Archive for a well-hidden cosmic gem. The competition attracted nearly one hundred entries and the winners were announced in January 2011. Astronomy enthusiast Igor Chekalin from Russia won the first prize — a trip to the Very Large Telescope at Paranal — in this difficult but rewarding challenge.

Pictures can be powerful; and astronomical images even more so: these views of distant cosmic worlds can inspire and help to connect us with the Universe. The images could almost be works of art when particularly intriguing shapes and phenomena are captured and presented in an appropriate way. Astronomical pictures are also an efficient way to pique people's interest in astronomy and science.

Over the past two and a half years ESO has boosted its production of outreach images, both in terms of quantity and quality, so as to become one of the best sources of astronomical images. In achieving this goal, the whole work flow from the initial production process, through to publication and promotion has been optimised and strengthened. The final outputs have been made easier to re-use in other products or channels by our partners.

While the pictures of the Universe that can be seen in ESO's releases are impressive, many hours of skilful work are required to first find datasets that can become useful "public" representations of the Universe, and then to process these into colour images. Along the way significant work goes into the astronomical processing — to assemble the raw greyscale data captured by the telescopes, to correct for the instrument signature, and to process the graphics — and in compressing the image's dynamic range to fit within the limited gamut of today's monitors and printers, enhancing them so as to bring out the details contained in the astronomical data[1].

The ESO Science Archive stores all the data acquired on Paranal, and most of the data obtained on La Silla since the late 1990s. This archive constitutes a goldmine commonly used for science projects (e.g., Haines et al., 2006), and for technical studies (e.g., Patat et al., 2011). But besides their scientific value, the imaging datasets in the archive also have great outreach potential.

ESO has a small team of professional image processors, but for ESO's Hidden Treasures competition, the experts decided to give astronomy and photography enthusiasts the opportunity to show the world what they could do with the data contained in the archive. A simplified interface to the ESO Science Archive was prepared by the Archive Group for this purpose and the goal of the competition seemed at first glance simple: to produce a good outreach image with a dataset from the ESO Science Archive that had not yet been published.

The enthusiasts who responded to the call submitted nearly 100 entries in total — far exceeding initial expectations, given the difficult nature of the challenge. Navigating the Science Archive has a steep learning curve for a new user due to the