

Preface: Site testing campaign for the Large Optical/infrared Telescope of China

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Abstract The Large Optical/infrared Telescope of China is a 12 meter diameter ground-based optical/infrared telescope which is proposed to be constructed in the western part of China in favor of its arid climate, and clear, dark nights. A site testing campaign was initiated between November 2016 and March 2019 in order to investigate long term astronomical weather conditions in the western part of China, specifically, at three sites: Ali in Tibet, Daocheng in Sichuan and Muztagh-ata in Xinjiang. This is the first attempt to evaluate long term performances of three candidate sites with uniformly calibrated instruments and data collecting/processing methods for a two-year span in China. In this special issue, we present nine papers that describe the whole site testing campaign, including preparation, data collecting/processing methods, instrument set up at three candidate sites as well as detailed statistics for the measurement results from March 2017 to March 2019.

Key words: telescopes — site testing — methods: observational — instrumentation: miscellaneous

The Large Optical/infrared Telescope of China is a proposed 12 meter diameter ground-based optical/infrared telescope. In order to fully realize its potential performance, especially considering this would be the flagship optical/infrared telescope in China in the near future, it is critical to find a site that has the best observational conditions in terms of seeing, cloud cover, night background, water vapor content and other meteorological parameters. Moreover, it is also very important that the site is relatively easy for construction and maintenance, and for travel and accommodation. In 2016, the Center for Astronomical Mega-Science, Chinese Academy of Sciences (CAMS-CAS) assembled a site testing working group, with personnel from National Astronomical Observatories (NAOC), Yunnan Observatories (YAO), Xinjiang Astronomical Observatory (XAO), Nanjing Institute of Astronomical Optics & Technology (NIAOT) and Shanghai Astronomical Observatory (SHAO) of the Chinese Academy of Sciences (CAS). The goals of the working group were: (1) to find candidate sites in the western part of China; (2) monitoring those sites continuously for at least a two-year period. All the monitoring instruments were uniformly calibrated at Xinglong Station of NAOC before being moved to the candidate sites. The data collecting/processing methods were also the same in order to guarantee that the measurement results were statistically comparable for all candidate sites.

After analyzing long term cloud data from remote sensing satellites and also incorporating weather data from national ground-based weather stations and results from early site testing efforts, three candidates were chosen: Ali in Tibet, Daocheng in Sichuan and Muztagh-ata in Xinjiang (Feng et al. 2020).

The site testing campaign was carried out between March 2017 and March 2019. To ensure success of the testing campaign, more than 70 people were involved in the working group during the process. CAMS-CAS also invited external site testing experts from China, Europe and North America as consultants to share their valuable knowledge and opinions on how to improve our site testing works from time to time. Three consultation meetings including experts from those countries/regions were held in June 2017, March 2018 and March 2019.

All three sites are located at altitudes higher than 4000 meters. With minimal living condition and overcoming health challenges due to high altitude and various technical problems caused by harsh weathers, the working group successfully collected a continuous two year data set for all three sites by the end. From this large data set, we have collected the following data for the three sites, Ali, Daocheng and Muztagh-ata, respectively:

- (1) 457, 357 and 422 nights of effective seeing data,
- (2) 697, 590 and 694 nights of effective all sky camera data,

- (3) 675, 559 and 705 nights of effective standard weather station data,
- (4) 603, 629 and 673 nights of sky background data.

This is the largest and longest continuous astronomical site testing data set in China by far to our knowledge. In this special issue of *Research in Astronomy and Astrophysics*, we will present all the works and results we obtained, including preparing, collecting and processing the data.

There are nine papers in this special issue, which we list below:

- (1) “Site testing campaign for the Large Optical/infrared Telescope of China: Overview” by Feng et al. (2020). This paper gives a general view of the testing campaign, including the background of the testing campaign, results from remote sensing data study, the test setup at each site and data processing method in general. It also provides statistical results of measurements from all instruments for all three sites.
- (2) “Long-term Analysis of Clear Nights Using Satellite Data Considering Astronomical Sites in Western China” by Cao et al. (2020a). This paper reports the detailed results about clear nights from 20 years of data from two satellites that help us in selecting the location of the three candidate sites before the actual on site monitoring phase.
- (3) “Data Processing and Data Products from 2017 to 2019 Campaign of Astronomical Site Testing at Ali, Daocheng and Muztagh-ata” by Cao et al. (2020b). This paper summarizes the collected data set and the data processing methods for various kinds of parameters.
- (4) “Introduction to the Environmental Monitoring Instruments for LOT” by Wang et al. (2020). This paper describes the site testing instruments and their parameters.

More detailed information regarding each sites’ general information, test setups, and additional and more detailed analysis results of measurement data were included in the papers from each site’s monitoring team. These are:

- (5) “Site Testing Campaign for the Large Optical/infrared Telescope at the Ali site” by Liu et al. (2020).
- (6) “Site Testing Campaign for the Large Optical/infrared Telescope of China: General Introduction of the Daocheng site” by Song et al. (2020).
- (7) “Site-testing at Muztagh-ata Site I: Ground Meteorology and Sky Brightness” by Xu et al. (2020a).
- (8) “Site-testing at Muztagh-ata Site II: Seeing Statistics” by Xu et al. (2020b).
- (9) “Site-testing at Muztagh-ata Site III: Temperature Inversion in Surface-layer Atmosphere” by Xu et al. (2020c).

The site testing campaign was initially motivated and started because of the Large Optical/infrared Telescope project, but its results would also be beneficial for all optical and infrared telescopes that have been built or are planned to be built in China. Its preparation and analysis done in the early phase might also be interesting for similar works as a reference. We hope these papers can help our readers gain a better understanding of these sites’ characteristics and performances, and spark more interest and insights into these unique regions in the western part of China.

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