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MOSE : A demonstrator for an automatic operational system for the optical turbulence forecast for ESO sites

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"Most of the observations performed with new-generation ground-based telescopes are employing the Service Mode. To optimize the flexible-scheduling of scientific programs and instruments, the optical turbulence (OT) forecast is a must, particularly when observations are supported by adaptive optics (AO) and Interferometry. Reliable OT forecast are crucial to optimize the usage of AO and interferometric facilities which is not possible when using only optical measurements. Numerical techniques are the best placed to achieve such a goal. The MOSE project (MOdeling ESO Sites), co-funded by ESO, aimed at proving the feasibility of the forecast of (1) all the classical atmospheric parameters (such as temperature, wind speed and direction, relative humidity) and (2) the optical turbulence i.e. the CN 2 profiles and all the main integrated astro-climatic parameters derived from the CN 2 (the seeing, the isoplanatic angle, the wavefront coherence time) above the two ESO sites of Cerro Paranal and Cerro Armazones. The proposed technique is based on the use of a non-hydrostatic atmospheric meso-scale model and a dedicated code for the optical turbulence. The final goal of the project aimed at implementing an automatic system for the operational forecasts of the aforementioned parameters to support the astronomical observations above the two sites. MOSE Phase A and B have been completed and a set of dedicated papers have been published on the topic. Model performances have been extensively quantified with several dedicated figures of merit and we proved that our tool is able to provide reliable forecasts of optical turbulence and atmospheric parameters with very satisfactory score of success. This should guarantee us to make a step ahead in the framework of the Service Mode of new generation telescopes. A conceptual design as well as an operational plan of the automatic system has been submitted to ESO as integral part of the feasibility study. We completed a negotiation with ESO for the implementation of the demonstrator of system on March 2016. In this seminar I will review the principles on which the proposed technique is based on; I will briefly review the most important challenges associated to the optical turbulence forecast for ground-based observations, I will summarize the most important results we achieved at conclusion of the feasibility study, how our results open new scenarios for the operation of the most sophisticated AO systems (WFAO), the next steps for the implementation of a demonstrator and plans for the forecast of further parameters. I will conclude showing a few outputs of the operational system we implemented for the LBT in the context of a similar project (ALTA Project). "