FOUR CRITERIA TO FIND AN OPTIMAL LOCATION IN COLOMBIA FOR A MILLIMETER WAVE ASTRONOMICAL OBSERVATORY

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To find an optimal location for a mm-wave astronomical observatory, all factors that directly or indirectly affect the water vapor column density should be considered. After estimating a weighted classification of these factors to obtain a range of acceptable values, places satisfying as many of these suitability conditions can be proposed as candidates.

Here we analyze data from NASA and IDEAM to find places satisfying the best conditions to build a mm-wave astronomical observatory in Colombia, according to seven variables grouped into four classes. From NASA, we analyze the satellite data of: **(i)** relative humidity and **(ii)** cloud coverage/direct normal radiation, averaged monthly from 1983 to 2005. From IDEAM, we analyze data of relative humidity, sunshine, and **(iii)** precipitation/number of days with rain, averaged yearly over each month from 1981 to 2010. The data has been obtained *in-situ* by 2046 weather monitoring stations across Colombia, for which their **(iv)** altitude is known. For each quantity, we do a Principal Component Analysis, reducing the dimensionality of the yearly-averaged data to 2 components covering >90% of the variance. After this, we make a classification of the reduced-dimension data using a 4 cluster Gaussian Mixture Model (GMM), identifying similar geographic and climatological patterns. After selecting clusters of stations sharing optimal conditions (i.e. high altitude, low rain, etc.), we group and look for geographical clusters by applying a GMM on a Monte Carlo sampling of latitude, longitude, and altitude data in order to correct for biases. This method allows us to find regions of interest where further *in-situ* measurements of atmospheric absorption of mm-wave should be carried out in the future.

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TWINKLE - A LOW EARTH ORBIT VISIBLE AND INFRARED EXOPLANET SPECTROSCOPY OBSERVATORY

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Twinkle is a space mission designed for visible and near-IR spectroscopic observations of extrasolar planets. Twinkle's highly stable instrument will allow the photometric and spectroscopic observation of a wide range of planetary classes around different types of stars, with a focus on bright sources close to the ecliptic. The planets will be observed through transit and eclipse photometry and spectroscopy, as well as phase curves, eclipse mapping and multiple narrow-band time-series. The targets observed by Twinkle will be composed of known exoplanets mainly discovered by existing and upcoming ground surveys in our galaxy and will also feature new discoveries by space observatories (K2, GAIA, Cheops, TESS). Twinkle is a small satellite with a payload designed to perform high-quality astrophysical observations while adapting to the design of an existing Low Earth Orbit commercial satellite platform. The SSTL-300 bus, to be launched into a low-Earth sun-synchronous polar orbit by 2019, will carry a half-meter class telescope with two instruments (visible and near-IR spectrographs - between 0.4 and 4.5μm - with resolving power R$\sim$300 at the lower end of the wavelength scale) using mostly flight proven spacecraft systems designed by Surrey Satellite Technology Ltd and a combination of high TRL instrumentation and a few lower TRL elements built by a consortium of UK institutes. The Twinkle design will enable the observation of the chemical composition and weather of at least 100 exoplanets in the Milky Way, including super-Earths (rocky planets 1-10 times the mass of Earth), Neptunes, sub-Neptunes and gas giants like Jupiter. It will also allow the follow-up photometric observations of 1000+ exoplanets in the visible and infrared, as well as observations of Solar system objects, bright stars and disks.

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