

## **Exo-climatology by means of ExoplAn3T-ARTECS interconnection**

The discovery of terrestrial-type exoplanets and the possibility of characterizing their surface properties, triggered in the astronomical community an intense modeling activity aimed at interpreting observations. This activity will be more and more important in view of the data which will be expected from new missions and instruments. To cite just few: JWST, eELT, Cheops, Plato, Ariel, LIFE, Euclid and many others.

Exo-climatology (i.e., climatology applied to exoplanets) can be seen as a generalization of terrestrial climatology, applied to other planets. The aim of this young discipline is to produce models capable of interpreting the few available astronomical observations of exoplanets and to infer their possible climate and atmospheric states.

From a set of parameters characterizing the state of a planet, such as: the spectral class of the host star, the mass of the exoplanet, its atmospheric composition, the orbital period, and many others, a climatological model derives an atmospheric p/T profile and composition, and a set of climatic indices characterizing the status of the planet, among them: the planetary surface habitability.

The exoplanetary & astrobiology research group at INAF-OA Trieste, in collaboration with IGG-CNR, PoliTO, and within the ASI “Life in Space” project, is focused on climatic and atmospheric models specifically suited to study, simulate and interpret observations of exoplanets. The ESTM code developed to these aims at OAT has allowed the production of the ARTECS exoclimate database (<https://wwwuser.oats.inaf.it/exobio/climates/>).

Results from these models can be used to interpret astronomical observations of exoplanets, such as the transit depth or the extinction spectrum of their atmospheres, or to study their climatic evolution allowing to assess their long-term habitability. This means to explore a large and complex parameter space, a time-consuming operation, for this reason a database of simulated exoclimates derived from ESTM has been produced in the last years, allowing the exploration of at least 24000 models.

Recently a collaboration between this team and ASI-SSDC started, aimed at integrating ARTECS with the SSDC exoplanets exploration tool *ExoplAn3T* (<https://tools.ssdsc.asi.it/exoplanet/>). When completed an *ExoplAn3T* user would be able to find inside ARTECS which models would be useful to describe a particular observation in *ExoplAn3T*. In case no models would be available, they could be generated. Conversely, an ARTECS user might know to which observed exoplanets a given model could be applied.

The selected researcher, whose work will be spent partially in the ASI HQ in Rome and partially at INAF-OATS in Trieste, is expected to contribute to this activity by finding and studying interesting use cases to adequately exploit the capabilities of this synergy between ARTECS and ExoplAn3T, with the possibility of paving a new way in the study of exoplanets, exosystems and exoclimates mining in an efficient (based on the Virtual Observatory standard) and innovative (as the data are linked through a dedicated webtool) way the wealth of data currently acquired by ground-based and space telescopes dedicated to the exoplanetary sciences.