SCOOP

Towards a synergistic study of the atmosphere of terrestrial planets

DURATION
15/12/2014 – 15/03/2019

BUDGET
500.986 €

PROJECT DESCRIPTION

The thermal structure of an atmosphere is a result of the radiative and convective equilibrium driven by the incidence of solar radiation, which is scattered, absorbed or emitted by the atmosphere itself and the planet surface. The absorbed energy is then released as infrared radiation. The energy balance is influenced by the atmospheric composition and by the presence of clouds and aerosols. The thermal structure is a driver of the global circulation which in turn influences the atmospheric composition. Therefore, understanding Mars' and Venus' current climate requires a multidisciplinary approach.

The first major objective of this project is a self-consistent compilation of the three dimensional thermal structure of the Mars and Venus atmospheres. The network will use VEX, MEX, TGO and MAVEN data for a better understanding of the related dynamics. In addition, the understanding of the mechanisms leading to the vertical structure of the Mars and Venus atmospheres obtained from compiled observations still needs clarification. Infrared properties of aerosols and trace gases play a large role in trapping or emitting heat. Therefore a better knowledge of the vertical distribution of radiatively active trace gases and aerosols in the atmosphere of Venus and Mars, which influences the vertical distribution of energy in the atmosphere, is the second main objective. Mapping of constituents can potentially serve the identification of sources of key trace gases, the quantification of the global circulation and of the atmospheric chemistry. This aspect constitutes a third objective as the spatial and temporal variability of trace gases still escapes present models.

Each WP and task tackles the scientific objectives in a strongly synergistic approach. The methodology includes the following steps:
1) Collection and rational combination of relevant data from past and current missions;
2) Application of improved and innovative tools to the collected data;
3) Analysis of the results using models;
4) Extract information important for the observation strategy of coming missions and for the definition of future missions.

The SCOOP network is built with an accent on close interaction and complementarity among expert teams as a goal in itself. Both the Planetary Aeronomy team at IASB-BIRA and LPAP at ULg play a leading role in Belgium in remote sensing of planetary neutral atmospheres and are both strongly involved in collecting, processing, analyzing and modelling planetary atmospheric observations performed with spatial instruments. While they obviously converge towards common objectives, they complement each other in many aspects of their respective expertise:
1) the study of the mesosphere versus the thermosphere,
2) expertise in spectroscopy in the UV versus IR,
3) mastery of absorption versus emission spectroscopy,
4) a strong implication in missions to Mars, ExoMars 2016 TGO versus MAVEN.

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The SCOOP activities and results will have an impact on the scientific community involved in the exploration of terrestrial planets bringing new elements in our understanding of Mars and Venus atmospheres.

SCOOP clearly is added value for the preparation of future European space missions towards terrestrial planets and therefore for European and Belgian policies. In particular, the scientific results sought by the SCOOP project will help to define scientific cases to be addressed by future missions to Mars and Venus. In addition, these planets are a natural laboratory for the understanding of Earth-like planets, their history, and their diversity. Therefore, their study informs society about our place in the Universe.

SCOOP will reach a wider scientific community by sharing its results through publications and conferences, and open release of the data obtained. The different means of dissemination through the Communication and Information Cell at IASB-BIRA will ensure that a wide public will also be reached.

The expected scientific results are:

1) a database of temperature data of the Martian dayside atmosphere;
2) an atmospheric model of the Venus mesosphere and lower thermosphere;
3) input for the revised Venus International Reference Atmosphere;
4) new retrieval tools in preparation for the analysis of the NOMAD data;
5) a better overall comprehension of the dynamics, structure and composition of terrestrial planets and the relationships between them;
6) additional means to define the strategy of observations for NOMAD, including clues for possible clathrates' outgassing;
7) tools to model atmospheric processes needed for the interpretation of the atmospheric parameters;
8) upgraded radiative transfer models necessary to comprehend geophysical quantities from spectroscopic data.

CONTACT INFORMATION

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LINKS

http://planetary.aeronomie.be/en/projects.htm

http://planetary.aeronomie.be/en/scoop.htm