Data Assimilation Schemes in Colombian Geodynamics - Cooperative Research Plan for 2017 - 2020 Between Universidad EAFIT and TUDelft, With the Help of Universidad de Antioquia and universidad Nacional de Colombia Sede Medellin

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Procedure Report - Copernicus Project 2D Satellite Data Analysis

Medellin Air qUality Initiative MAUI

MAUI-RP-02

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EDITION AND DISTRIBUTION CONTROL

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ABSTRACT

This report presents analysis of the 2D variables from Copernicus Project. The objective of the report is the characterization of the behavior and development of the 2D variables. The analysis is made through the methodology described in the Technical Report RT-01.

INTRODUCTION

Copernicus is a European Union Programme aimed at developing European information services based on satellite Earth Observation and in situ (non-space) data. The Programme is coordinated and managed by the European Commission. It is implemented in partnership with the Member States, the European Space Agency (ESA), the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT), the European Centre for Medium-Range Weather Forecasts (ECMWF), EU Agencies and Mercator Océan. Vast amounts of global data from satellites and from ground-based, airborne and seaborne measurement systems are being used to provide information to help service providers, public authorities and other international organisations improve the quality of life for the citizens of Europe. The information services provided are freely and openly accessible to its users.

The European Centre for Medium-Range Weather Forecasts (ECMWF) is an independent intergovernmental organization supported by 34 states. ECMWF is both a research institute and a 24/7 operational service, producing and disseminating numerical weather predictions to its Member States. This data is fully available to the national meteorological services in the Member States. The Centre also offers a catalogue of forecast data that can be purchased by businesses worldwide and other commercial customers. The supercomputer facility (and associated data archive) at ECMWF is one of the largest of its type in Europe and Member States can use 25% of its capacity for their own purposes. ECMWF provides current forecasts, climate reanalyzes and specific datasets. These are available via the web, point-to-point dissemination, data servers and broadcasting. All ECMWF's operational forecasts aim to assess the most likely forecast and also the degree of confidence one can have in that forecast. To do this the Centre carries out an ensemble of predictions which individually are full descriptions of the evolution of the weather, but collectively they assess the likelihood or probability of a range of possible future weather.

ANALYSIS

The spatial domain under analysis is defined from 25 to-10 north degrees (latitude), and from 60 to 85 degrees west (longitude). The spatial grid used by the model is a reduced Gaussian N640 grid, which results in 640 latitude values between the pole and the equator, providing and approximate resolution of 14 km. Samples are provided with a 3-hour sampling period. **¡Error! No se encuentra el origen de la referencia.** shows the corresponding domain of interest.

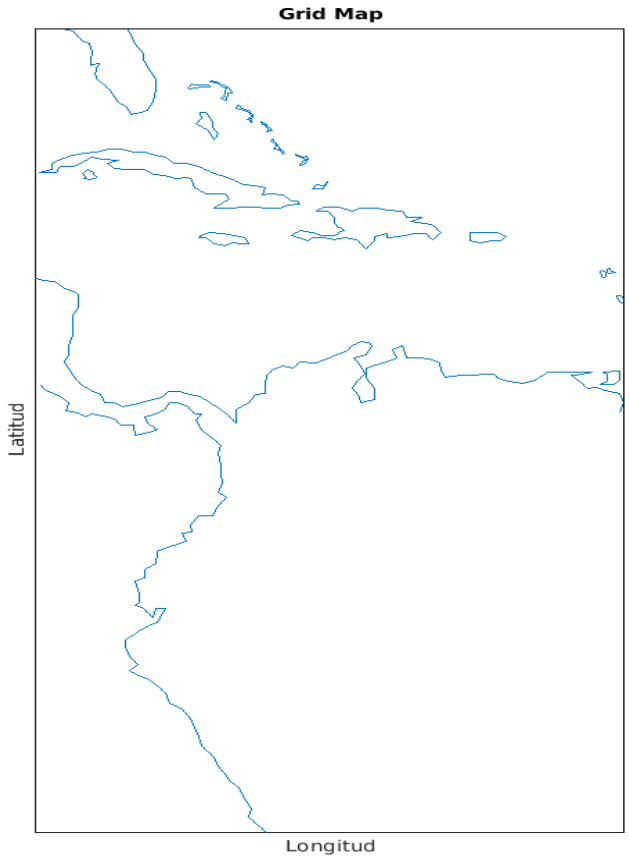

Figure 1. Grid map over the whole domain.

The group has special interest in the behavior and development of the variables over the Aburrá Valley. **¡Error! No se encuentra el origen de la referencia.** shows the corresponding grid map. It is seen that the model resolution poorly represents the valley's topography, as its area is divided in four grid cells. For the analysis was selected the Point1.

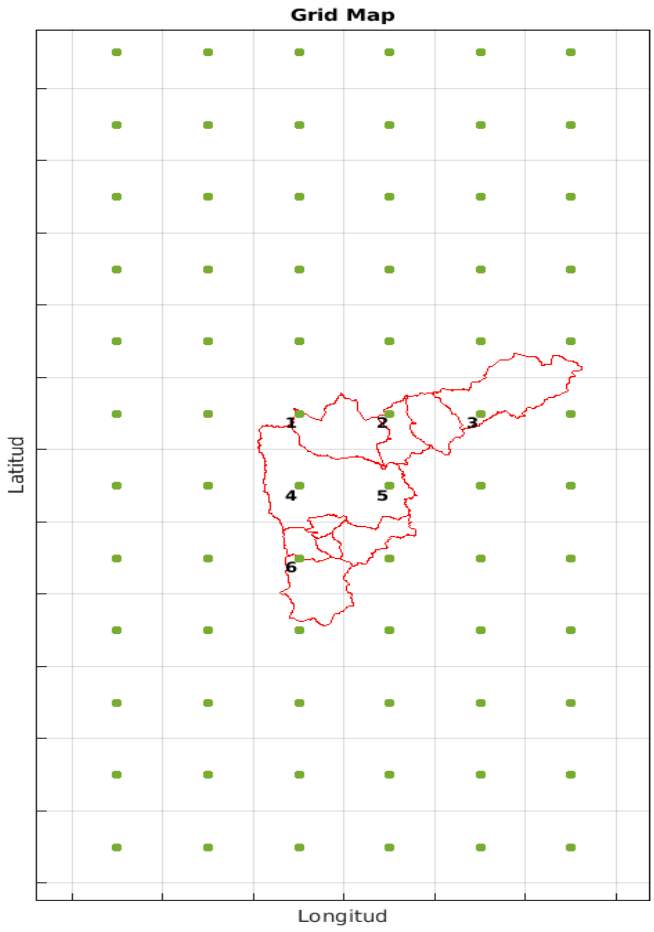

Figure 2. Grid map over the Aburrá Valley.

The variables 2D available are:

- Boundary Layer Height.

- 2 Metre Dewpoint temperature.
- Large sale precipitation.
- Surface solar radiation downward.
- 2 Metre Temperature.
- Total Cloud cover.
- 10 Metre U wind component.
- 10 Metre V wind component.

FREQUENCY ANALYSIS

Spectrum calculation is an essential analysis tool used to transform a time signal into the frequency domain, where periodicities and cycles can be evidenced. The Figure 3 shows the frequency spectrum for each variable.

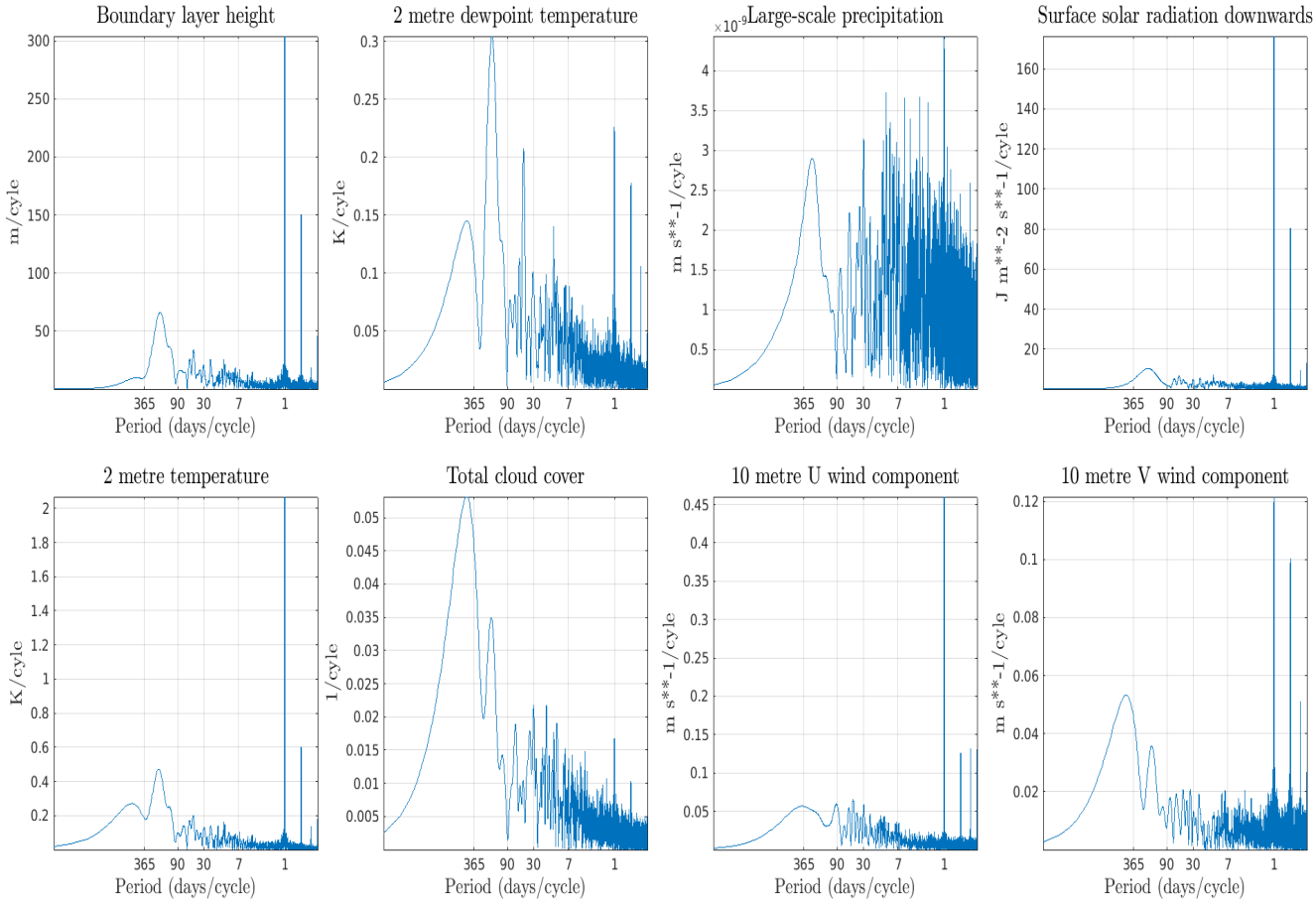

Figure 3. Frequency spectrum for variables 2D.

DAILY CYCLE

The daily cycle, variation of the substance concentration throughout the day, is of vital importance as it allows to detect critical moments, and associate this moments to possible causes, man-made or not. To provide a qualitative analysis, a scatter plot is proposed, where each point represents the concentration for a certain substance at a specific hour of day. In the Figure 4 is presented de Daily cycle for the variables 2D.

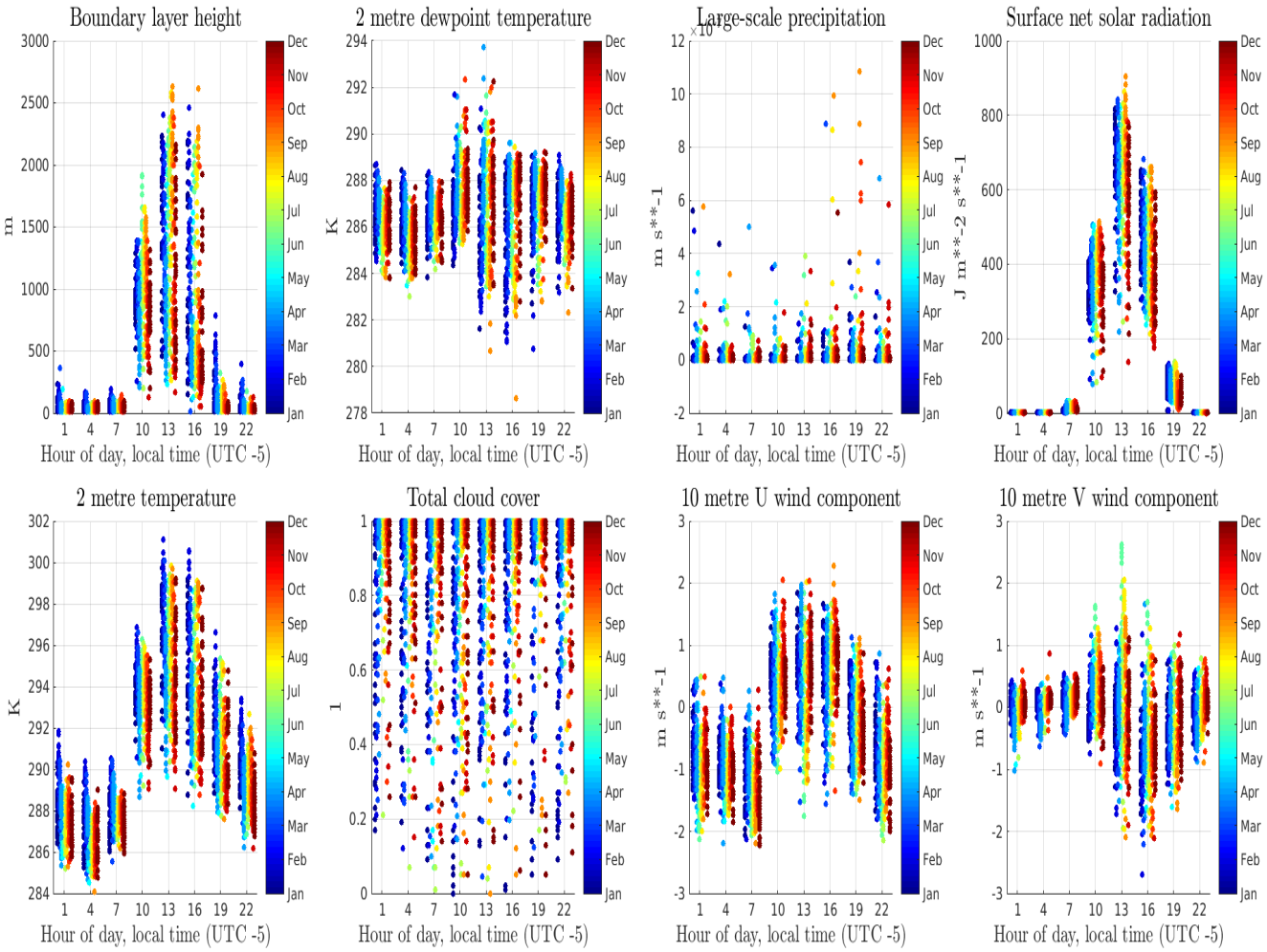

Figure 4.Daily cycle for the variables 2D.

DISTRIBUTION ANALYSIS

The daily cycle, variation of the substance concentration throughout the day, is of vital importance as it allows to detect critical moments. To provide a qualitative analysis, a scatter plot is proposed, where each point represents the value for the variable analyzed.

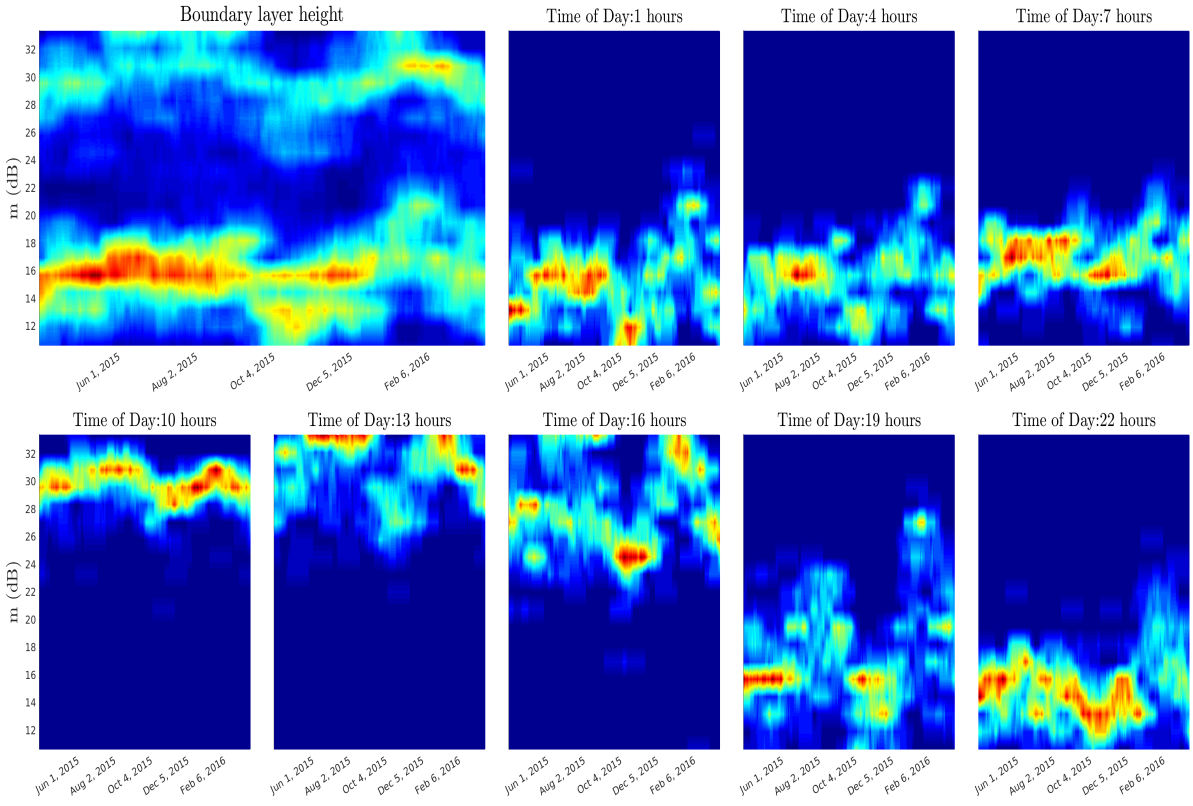

Figure 5. Distribution analysis for Boundary layer height.

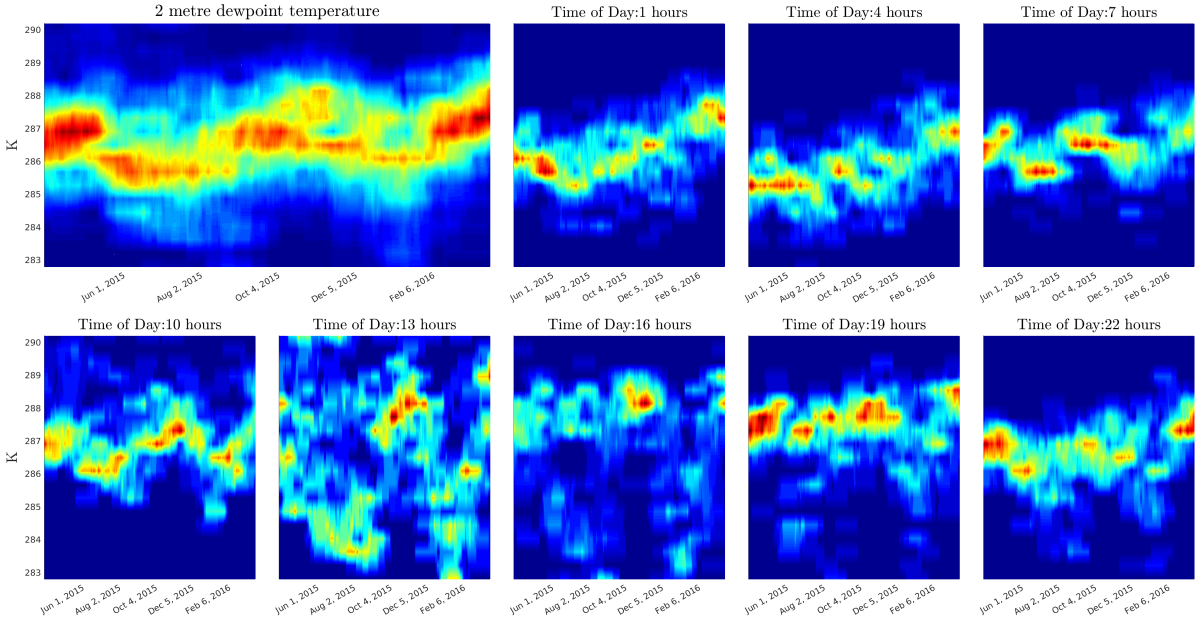

Figure 6. Distribution analysis for 2 metre dewpoint temperature.

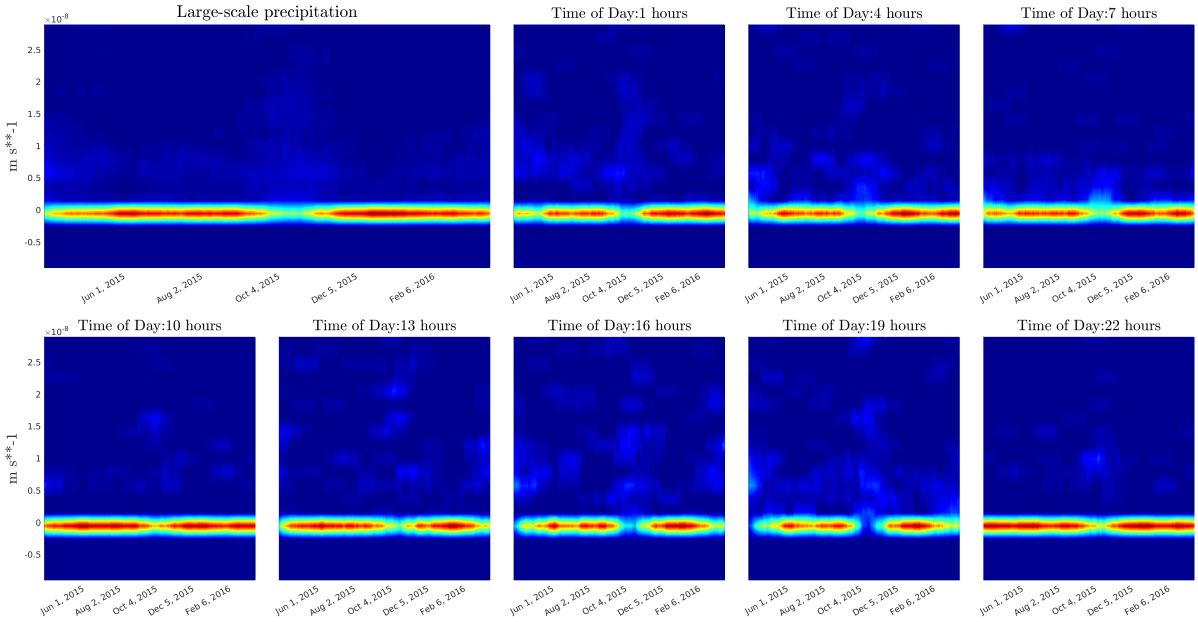

Figure 7. Distribution analysis for Large-scale precipitation.

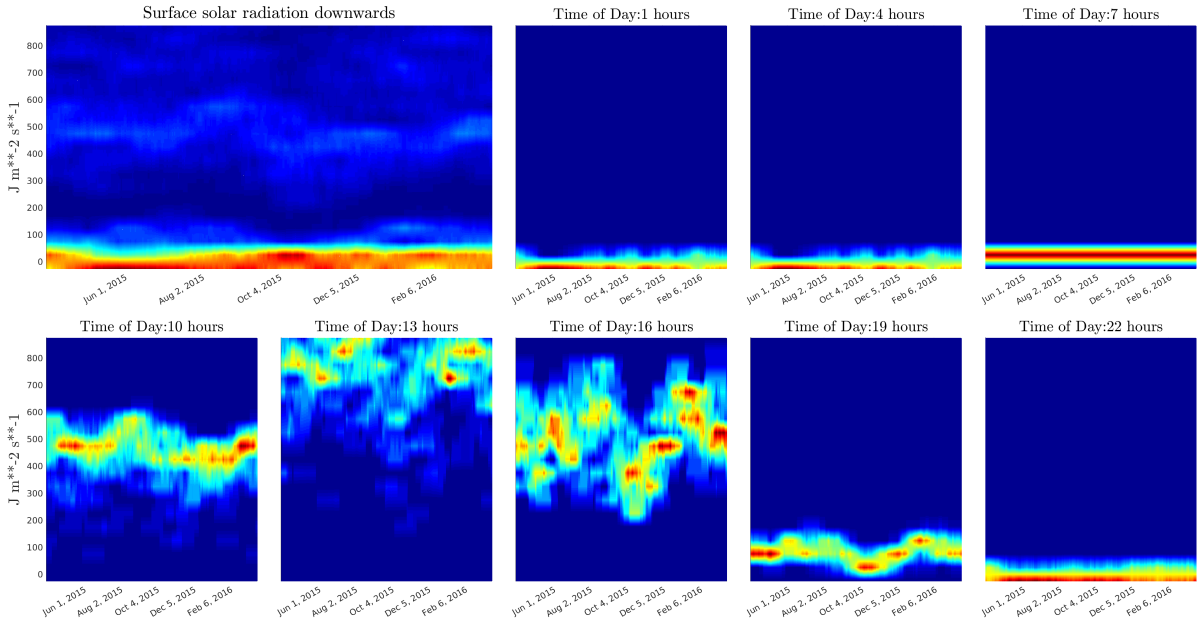

Figure 8. Distribution analysis for Surface solar radiation downwards.

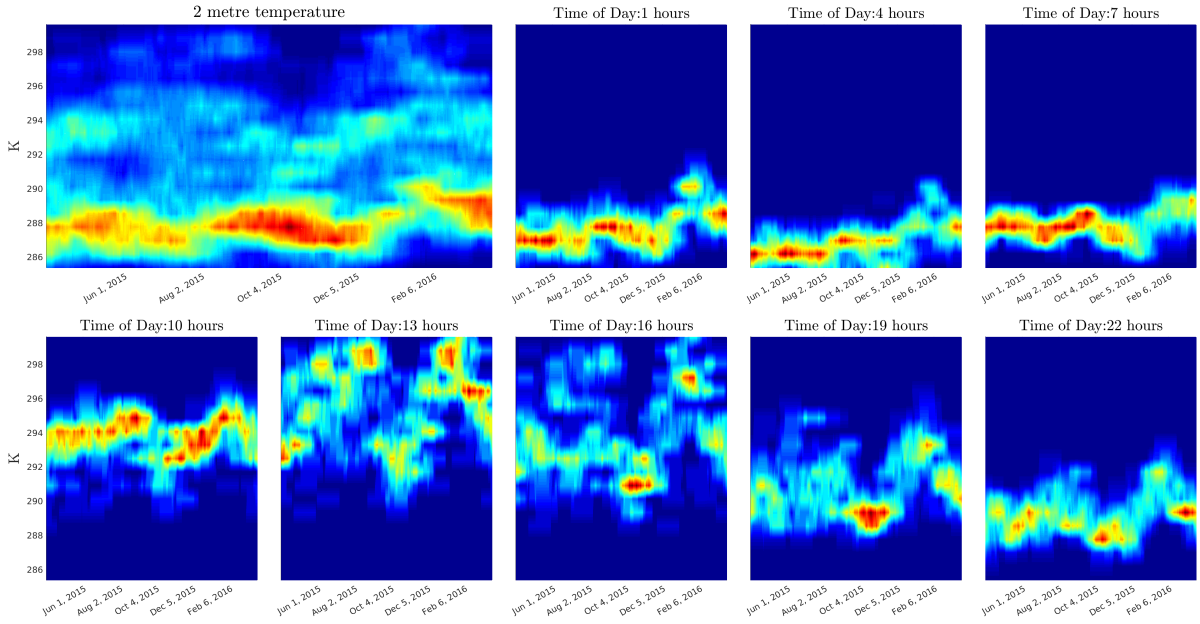

Figure 9. Distribution analysis for 2 metre temperature.

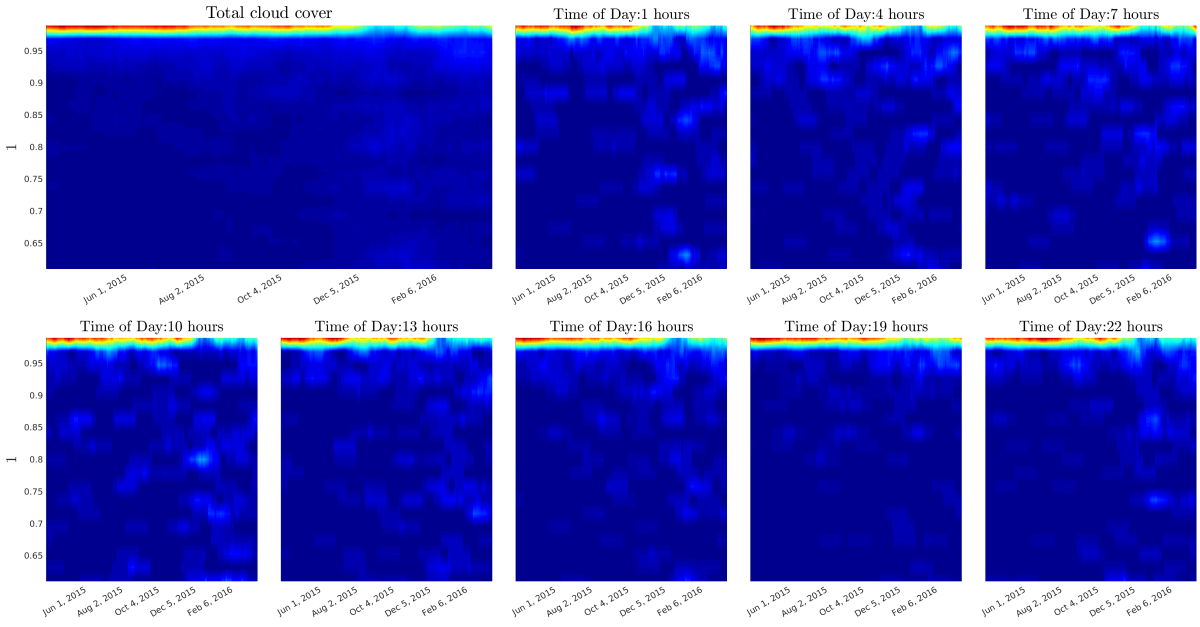

Figure 10. Distribution analysis for Total cloud cover.

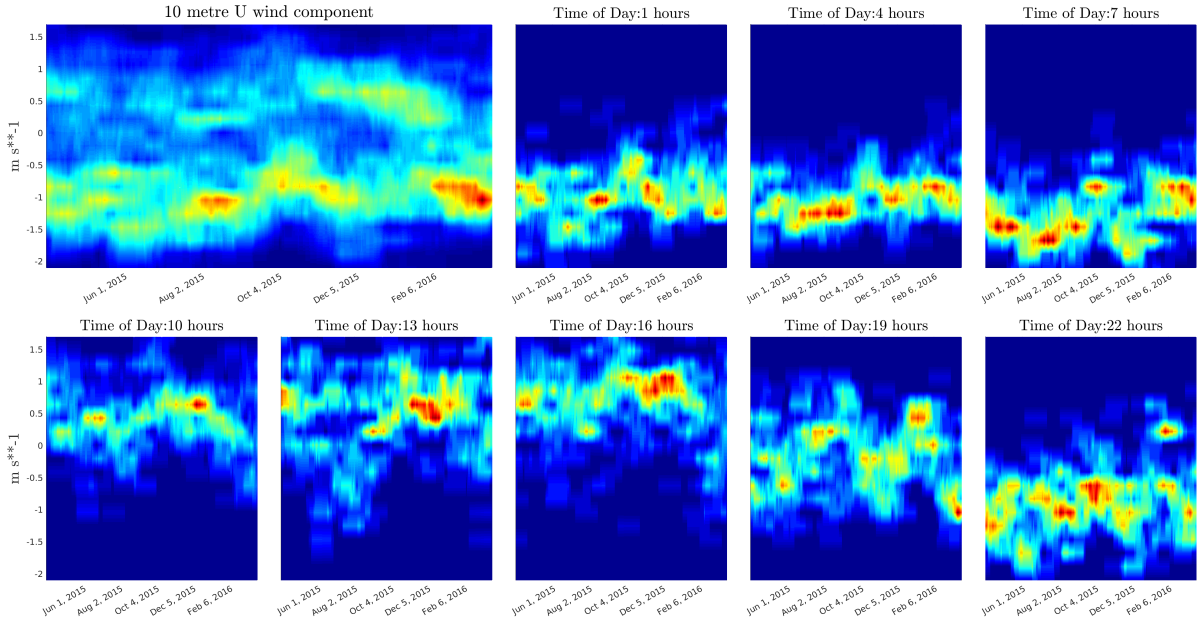

Figure 11. Distribution analysis for 10 metre U wind component.

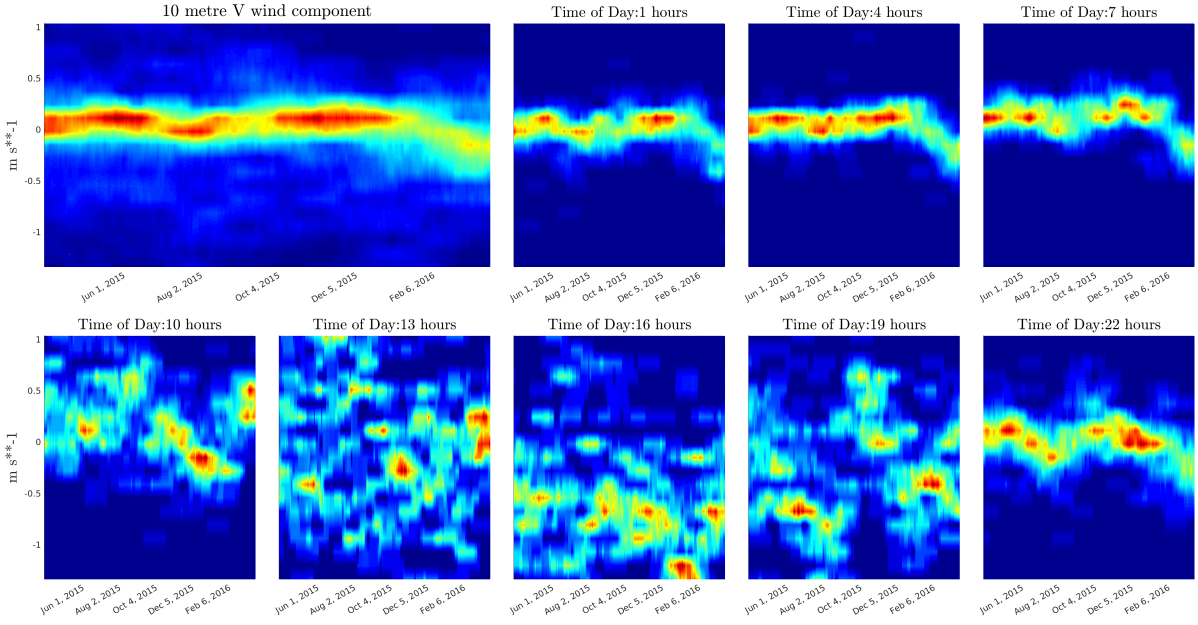

Figure 12. Distribution analysis for 10 metre V wind component.