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OSCAR (Observation System for Climate Application at Regional scale)

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Objectives

Specific objectives of the project are:

► Design and of a low-cost prototype able to provide integrated measurements for the quantification of the impact of climate variability on surface radiation

► Development of a methodology for the estimation of the impact of climate variability on surface radiation using the integration of the observations provided by prototype.

► Study of correlation between the surface radiation, precipitation and aerosols transport.

Partners:

Coordinator: Consiglio Nazionale delle Ricerche – Istituto di Metodologie per l'Analisi Ambientale (CNR-IMAA), PI Dr. Fabio Madonna

Partner 1: Finnish Meteorological Institute (FMI), PI Dr. Ewan O'Connor

Started officially on October, 1st

CNR-IMAA Advanced Observatory
CIAO

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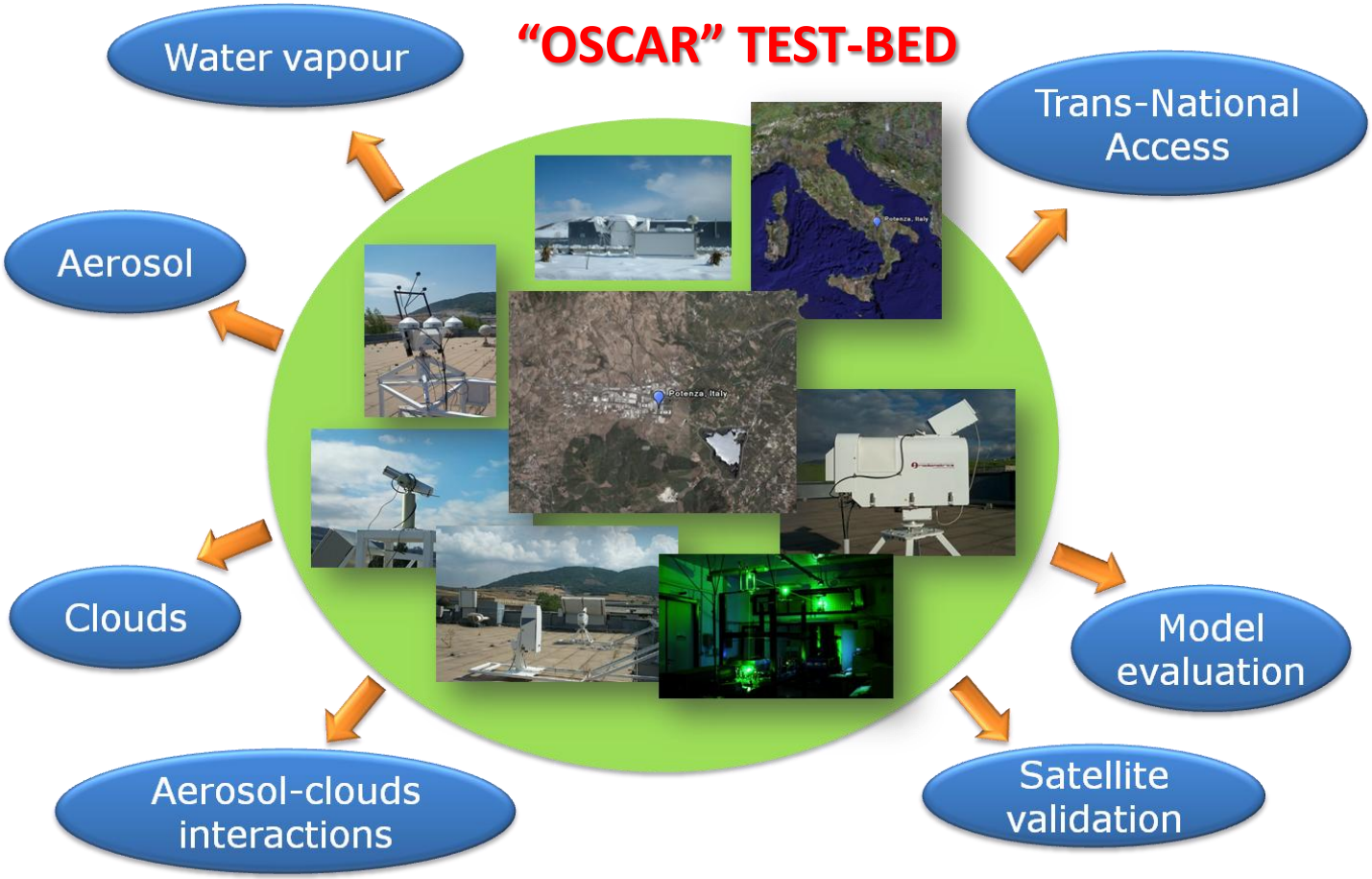
OSCAR



ACTRIS - Cloudnet

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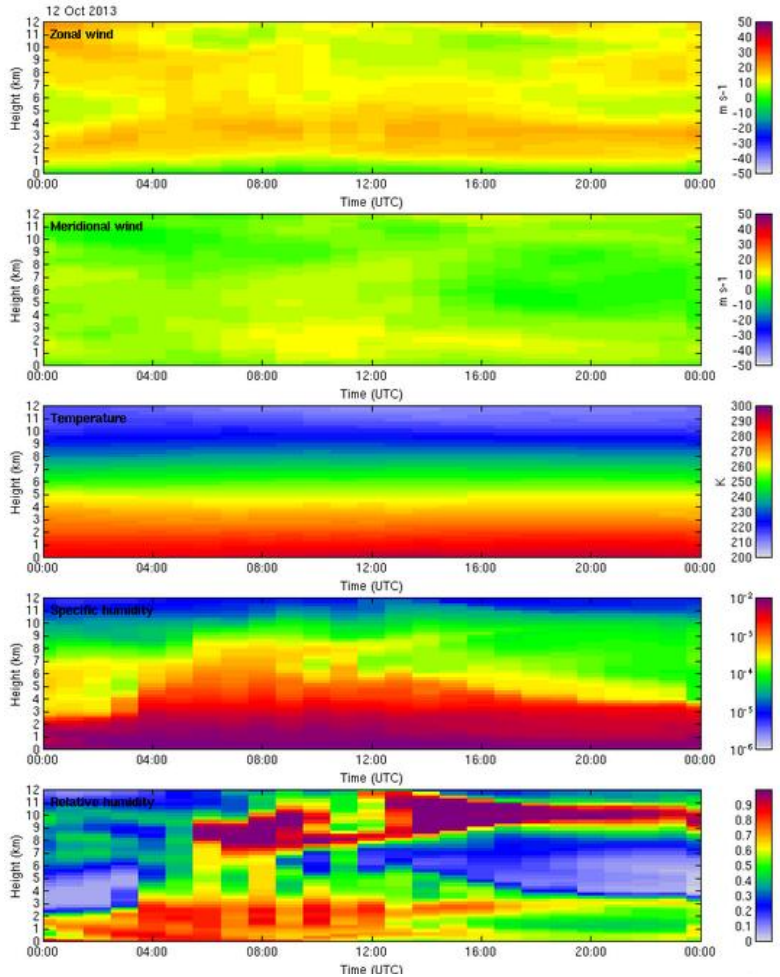

Cloudnet

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Quicklooks of Cloudnet data

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This page contains links to pages containing quicklooks of the Cloudnet data. Click on the text on the left to access the dataset web pages. See also quicklooks of data from the ARM fixed sites and the ARM Mobile Fac

- **Cabauw, Netherlands.** From the CESAR observatory.
- **Chilbolton, UK.** From the CFARR observatory.
- **Juelich, Germany.** From JOYCE, operated by IGMK and partners.
- **Leipzig, Germany.** From LACROS, operated by the Leibniz Institute for Tropospheric Research.
- **Lindenberg, Germany.** From the Lindenberg Meteorological Observatory operated by Deutscher Wetterdienst.
- **Mace Head, Ireland.** From the Mace Head Facility operated by NUI, Galway.
- **Palaiseau, France.** From the SIRTA observatory.
- **Potenza, Italy.** From CIAO, the CNR-IMAA atmospheric observatory.

Level 1 model data	Cabauw	Chilbolton	Juelich	Leipzig	Lindenberg	Mace Head	Palaiseau	Potenza
DWD COSMO EU (LME)	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks
DWD COSMO DE (LMK)	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks
ECMWF IFS	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks
Met Office UM (NAE)	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks
Met Office UM (global)	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks
Meteo France ARPEGE	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks
RACMO	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks
SMHI RCA	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks

Level 1 observational data	Cabauw	Chilbolton	Juelich	Leipzig	Lindenberg	Mace Head	Palaiseau	Potenza
Processed radar, lidar, microwave radiometer and rainqauge data	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks

Level 2 meteorological products	Cabauw	Chilbolton	Juelich	Leipzig	Lindenberg	Mace Head	Palaiseau	Potenza
Target classification	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks
Cloud fraction	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks
Turbulent kinetic energy dissipation rate	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks
Ice cloud properties (radar-lidar method)	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks
Ice cloud properties (radar-lidar IPSL method)	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks
Ice water content (radar-temperature method)	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks	Quicklooks

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Energy & Atmosphere

- Study of the techniques for using solar energy implies the knowledge of nature, ecosystem, biological factors and local climate.

- Climate change, both at global and regional scales, require a continuous monitoring of wind and solar radiation fields.

- Clouds, fog, water vapor, and the presence of large concentrations of dust can significantly affect the way to exploit the solar energy. Therefore, a quantitative characterization of the impact of climate variability at the regional scale is needed to increase the efficiency and sustainability of the energy system.

Clouds impact

Cluouds impact solar energy:

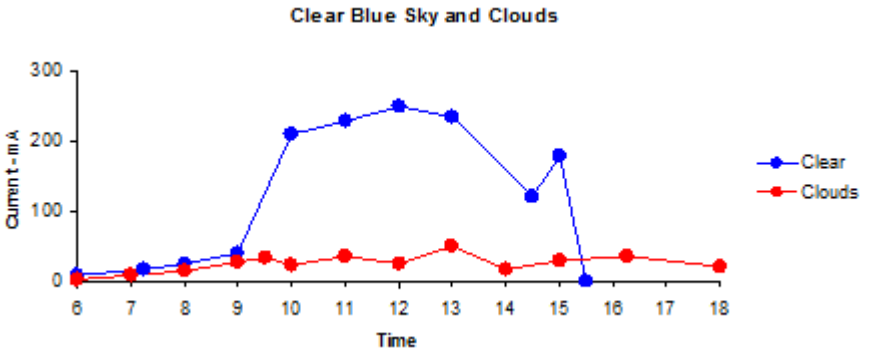
- because a solar power panel system produces electrical energy dependent on the level of light received.

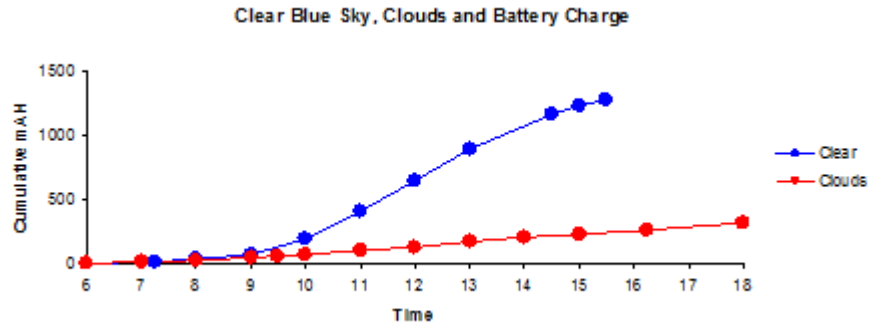
- When clouds fill the sky, covering the sun, light levels are reduced. But it doesn't mean that your solar power panel system stops producing power, it's output will reduce to about half if is there is enough light to cast shadows

- But the effect of clouds on a solar power panel can be surprisingly good as well (e.g. when the sun shines through a gap between clouds, the solar panels receive both direct sunlight and the light reflected from the clouds. This means more than they can receive on a clear sunny day!

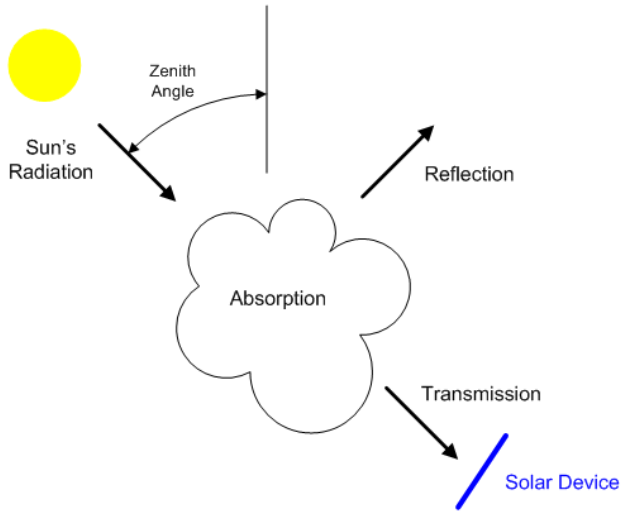
- For this reason, for example, in 2006, the largest solar park in the world was opened in Germany (e.g. a very cloudy country).

Clouds effect on efficiency of solar panels



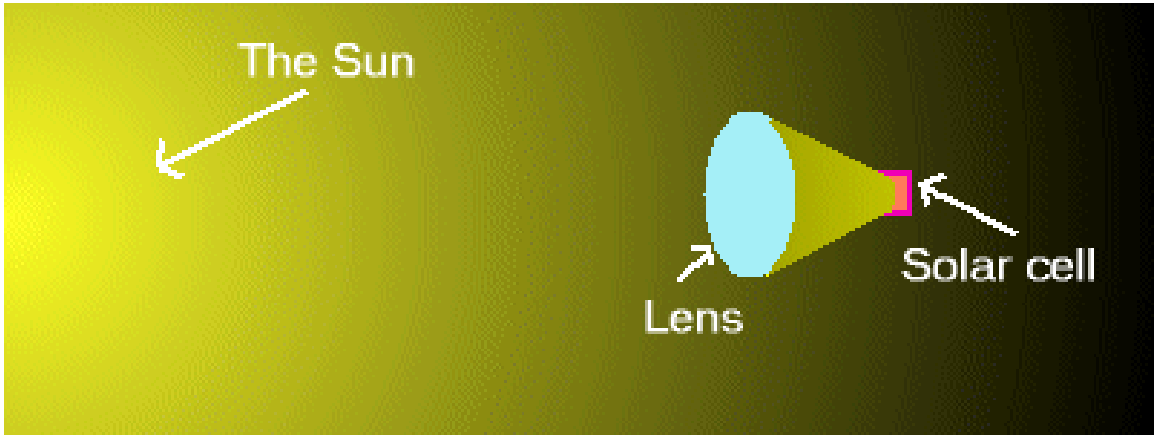


But the effect of clouds depends on the combination of their share and the solar angle!



Solar concentrator

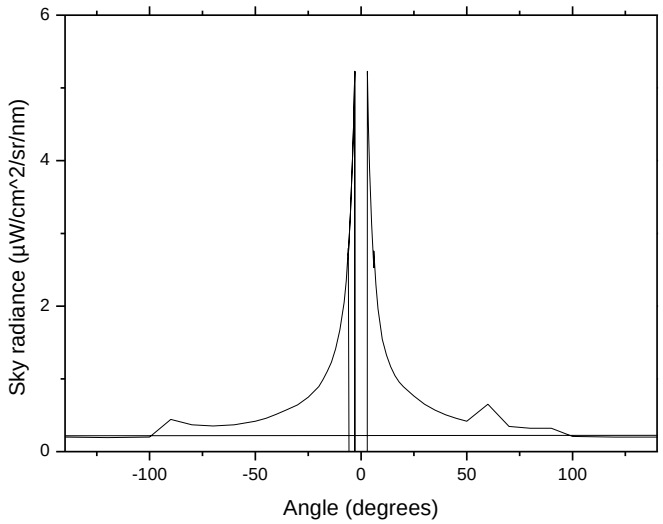
…and new technologies can better exploit also the scattered sunlight.



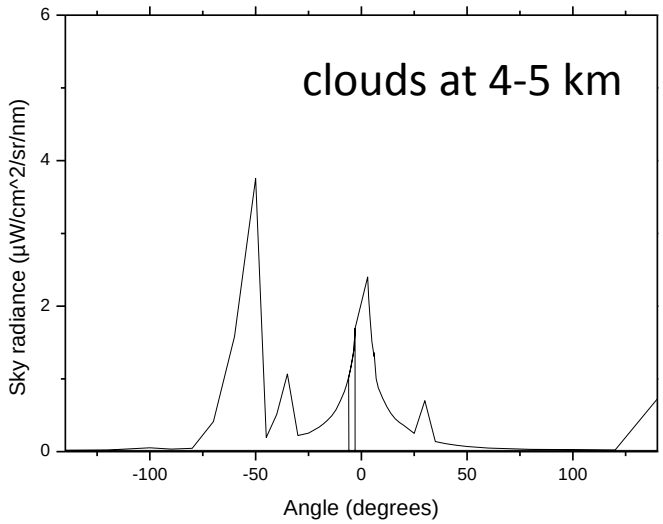
- A solar concentrator uses lenses, called Fresnel lenses, which take a large area of sunlight and direct it towards a specific spot by bending the rays of light and focusing them.
- Fresnel lenses are shaped like a dart board, with concentric rings of prisms around a lens that's a magnifying glass. All of these features let them focus scattered light from the Sun into a tight beam.
- Solar concentrators put one of these lenses on top of every solar cell. This makes much more focused light come to each solar cell, making the cells vastly more efficient.

Scattered sunlight

Without clouds



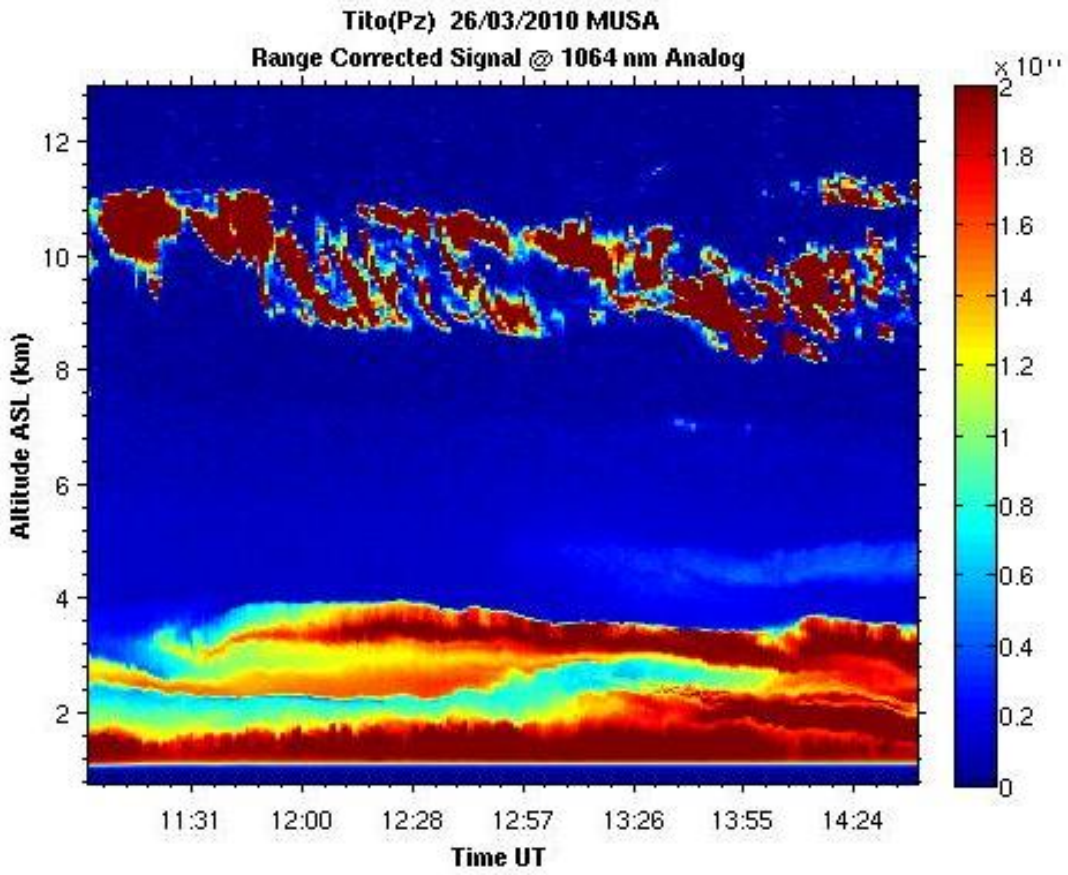
With clouds



… moreover, the amount of light absorbed and scattered by a cloud depends on the cloud type (e.g. altitude, composition, …..).

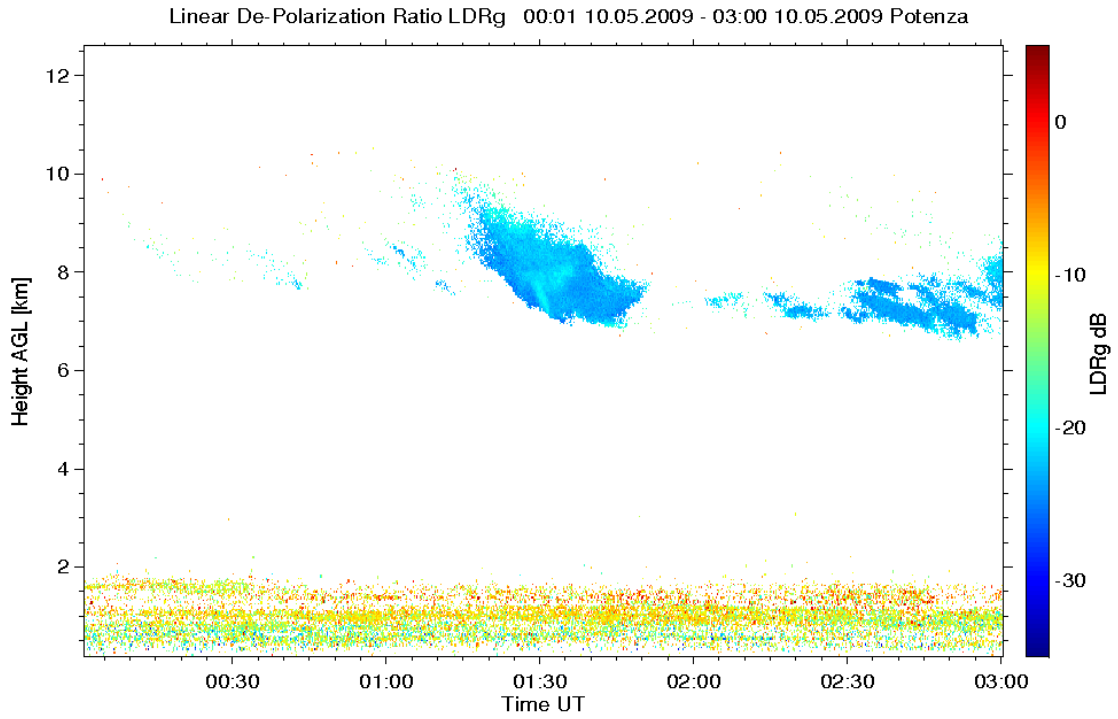
Clouds

Example of cloud identification using lidar



Clouds

Example of cloud typing using depolarization ratio



Particle shape is relevant to determine how clouds interact with the solar radiation.

Objective #1

Observation low cost station , mobile, portable, scanning for monitoring the climate at a regional scale

+

+

=

OSCAR prototype

Controlled using technologies such as mini-PC, smartphone or tablet (locally and remotely).

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Objective #2

Development of a methodology for estimating the impact of climate variability on the amount of surface radiation using the integration of the observations provided by the integrated prototype system. The minimum set of variables needed for this study will identified.

A few of the variables relevant to the study are:
- Cloud fraction
- Cloud height
- Cloud frequency
- Integrated water vapor
- Solar irradiance at the ground
- Aerosol optical depth
- Backscatter coefficient
- Visibility (fog)
- Accumulated amount of precipitation
- Meteorological surface parameters

Other variables will be studied and incorporated as a result of a preliminary evaluation of their relevance.

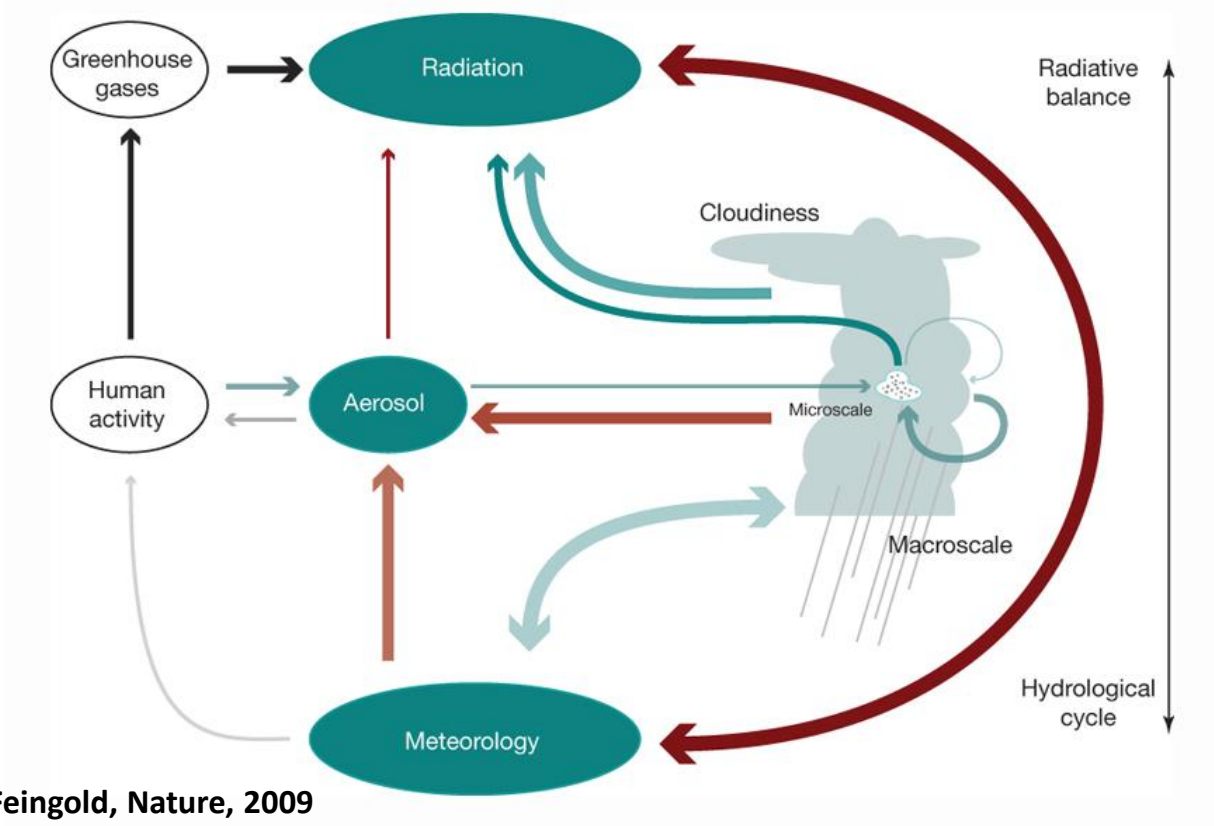
Objective #3

► Focus will be on the study of correlation between the surface radiation, extreme precipitation events and aerosol transport (eg., Saharan dust).

This will allows us to learn more about the real impact of aerosol outbreaks over the Mediterranean basin on these phenomena, quite frequently observed over our region, on the precipitation and on the hydrological cycle.

Aerosol

Role of aerosols in the atmospheric part of the hydrological cycle in heavy rainfall



Stevens, B. and G. Feingold, Nature, 2009

Products

- h24 data and quicklooks of the observations available at CIAO for the study of climate variability at the regional scale
- Software for analysis and archiving of all the observations provide by the OSCAR prototype.
- Software for the integration of observations and for the quantification of the impact of climate variability on the surface radiation.
- Handbook of the OSCAR prototype.
- Tests run at CIAO and reports of performance evaluation of the algorithms and the OSCAR prototype.
- Assessment report of the correlation between extreme rainfall events and aerosol transport.


OSCAR