Basic meteorology and UV measurements at BEO “Moussala”

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1. Basic meteo-data with AWS
2. UV_AB and UV_B pyranometers
3. Lightening phenomenology and protection system
# 1. Basic METEO DATA for peak MOUSSALA

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<table>
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<tbody>
<tr>
<td>Altitude</td>
<td>2925 m</td>
</tr>
<tr>
<td>Average annual temperature</td>
<td>- 3,1°C</td>
</tr>
<tr>
<td>Average monthly wind speed</td>
<td>10,5 – 4,9 m/s</td>
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<tr>
<td>Average annual wind speed</td>
<td>7,5 m/s</td>
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<tr>
<td>Average annual rainfalls</td>
<td>1000-1300 mm</td>
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Table. 1
VAA151, VAV151

Ultrasonic
WS425*

HMP45D
HUMIDITY
and
TEMPERATURE

QLI 50
DATA
LOGGER

PC DATA
COLLECTOR and
LAN

RAIN
GOUGE
RG13H

PRESSURE
SENSOR
PTB100B

Fig 1 AWS Vaisala FLOWCHART
Fig. 2 Temperature data for 2005 till 21-10-05
Fig. 3 Atmospheric pressure for 2005 till 21-10-05
Fig. 4 Humidity data example
Fig. 5 Precipitations for 2005 till 21-10-2005
Fig. 6 Average wind data chart
Wind sensor WS425

- Vaisala WINDCAP® Ultrasonic Wind Sensor WS425
- Measures wind speed and direction to hurricane, gales (0...65 m/s), including gusts
- Data availability and accuracy in all wind directions due to the three transducer layout
- Averaging of wind speed and direction
- Analog output
- No moving parts: virtually maintenance free
- Stainless steel construction
- Heated model
2. UV pyranometers at BEO Moussala
Fig 1 Typical spectral response of UV_B
Fig 2 Typical spectral response of UV_AB
Fig 3 Solid model of the UV pyranometers
Fig 4 Field measurements February
Fig 5 Field measurements June
Fig 6 Field measurements November
Fig 7 Irradiance for a clear day
Fig 8 Irradiance in a cloudy day
Fig 9 Actual field measurements of UV_B on 2005-10-07
3. LIGHTENING PROTECTION

phenomenology

and system
THE FRICTION CAUSES THE ELECTRICAL CHARGES TO SEPARATE...
Sometimes a small group of positive charges can be locked inside the negative mass. A vast difference in potential of tens of millions of volts is set up between the summit and the base of the cloud.
The difference in potential between the cloud and the ground is such that the discharge is imminent.

-150 V/m

15 to 20 kV/m
The air between the ground and the base of the cloud is traversed by an electric current.

- Negatively charged electrons are drawn from the ground and then rise up towards the summit of the cloud....

Consequently, the ground becomes positively charged.
WHEN THESE ELECTRONS RISE TO THE SUMMIT OF THE CLOUD, THEY NEUTRALISE POSITIVE CHARGES OF EQUAL VALUES...
FROM A POINT IN THE CLOUD, A LUMINOUS STREAK OF LIGHT FLASHES WHICH PROGRESSES RAPIDLY
THE PROCESS KEEPS ON REPEATING ITSELF...
BESIDES DESCENDING AND ASCENDING LIGHTNING SURGES, ANOTHER CLASSIFICATION OCCURS DEPENDING ON THE POLARITY OF THE LIGHTNING IMPACT (1/2)

*Lightning impact classification by K. Berger*
EARLY STREAMER EMISSION
LIGHTNING CONDUCTORS / SATELIT 3
The triggering advance ($t$) is the average gain in triggering time of the upward streamer of the ESE lightning conductor when compared with a simple rod lightning conductor. This gain is expressed in mks.
STANDARDS RELATING TO ESE LIGHTNING CONDUCTORS
• Creation of an ionised channel around the capture point, in order to increase the chance of capturing a lightning discharge.

• Three principles are used:
  - Ionisation by triggering effect
  - Natural convection of the air (chimney effect) at an elevated point
  - Acceleration of air circulation at the spark point by a VENTURI effect.
IONISATION:

- The ground electric field in dry sunny weather is in the order of -150 V/m. During the development of thundery conditions, it gradually changes to very positive values, with the discharge spike occurring at about 15 kV/m.

CONVECTION:

- The elevated position of the lightning conductor benefits from circulation of the air moving from below upwards: this is the phenomenon of natural convection of air.

ACCELERATION:

- The double upper casing has been designed in order to create a VENTURI effect channelling the ionised air and accelerating its circulation speed around the point.
DIAGRAM OF THE OPERATING PRINCIPLES

Capture point (stainless steel)

venturi channel

Field variation detector/Sensor

AIR

Voltage increase impulse transformer

Impulse generator

Memorising the energy collected

External electrodes for discharges (Corona Effect): Initialising the upward streamer
LABORATORY TESTS: COMPARATIVE RESULTS

EARLY STREAMER EMISSION LIGHTNING CONDUCTOR

SIMPLE ROD LIGHTNING CONDUCTOR