

# **Cyclogenesis in the Western Mediterranean causing Heavy-Rain Events (NEPTUN)**

**A Proposal for a coordinated mission of the HALO research aircraft  
in the field  
“Transport processes and atmospheric dynamics”**

by

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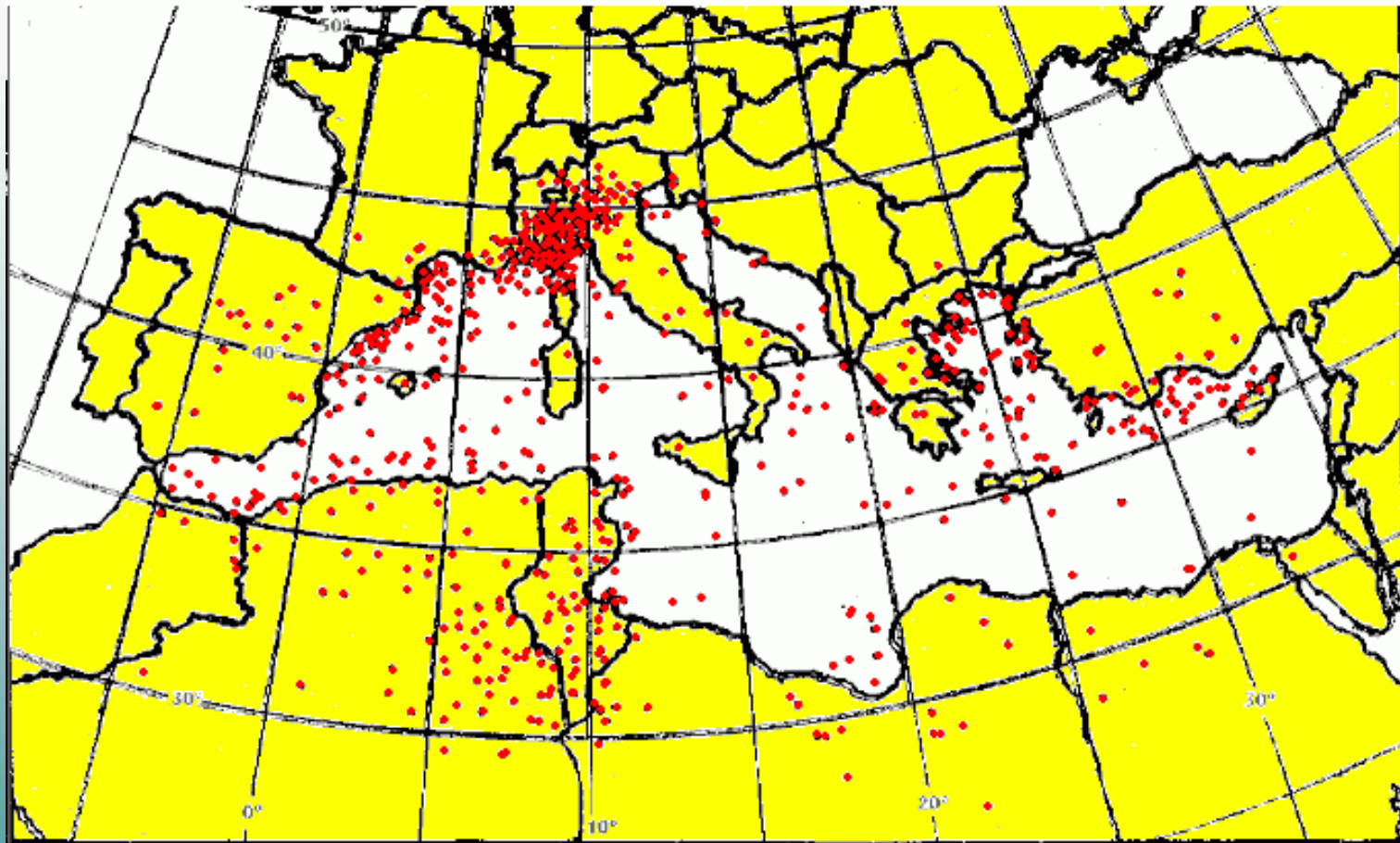


# Häufigkeit der Cyclognese im Mittelmeer

(nach Reiter 1975)

Jeder Punkt entspricht einem an diesem Ort entstandenen Tief.

Beobachtungszeitraum: 1 Jahr



Fundstelle: <http://www.inm.es/wwi/palma/JANSA/JANSA1.HTM>



## Objectives

The development of **cyclones** over the **western Mediterranean** especially in late autumn is often associated with **heavy-rain events in southeastern France and northern Italy**.

Large scale **lifting** combined with **embedded convection** and intensified by the orography of the western Alps and the Apennines may cause **flash floods in the narrow mountain valleys** due to rainfall of more than 300 mm m<sup>-2</sup> per 24 hours.

The heavy-rain events are the results of combined **advective and convective water vapour transport**. The interaction of processes initiating precipitation on different scales causes **problems in Quantitative Precipitation Forecast**.

In the last decade usually at least one cyclone per year caused enormous damage and losses of human lives by floods in that specific area. **It is the objective of the proposal to study the impact of additional airborne measurements on the prediction of cyclones potentially causing heavy impact weather.**



## Severe cases of mesoscale cyclogenesis associated with heavy flash floods

Episode	Country	Date	Max. precipitation in 24 hours
Vaison-la-Romaine	France	22.-23. 09. 92	300 mm at selected sites
Brig	Switzerland	23.-25. 09. 93	120 mm (23.09), 220 mm (24.09.)
Piedmont	Italy	04.-06. 11. 94	314 mm, 250 at several sites
Ticino	Italy	12.-13. 09. 95	186 mm in 12 h, 327 mm in 36 h
Friuli	Italy	19. 09. 95	180 mm
Friuli	Italy	05.-07. 10. 98	~ 250 mm in 48 h
Thyrrhenian Sea		26.-27. 03. 99	



## Specific problems of flash flood cases

Many authors state that simulation of the large scale features of the cyclogenesis and the amount of precipitation connected with accompanied lifting is quite satisfying, while **the prediction of rainfall caused by embedded pre-frontal rain bands and convective cells triggered by the orography shows often insufficient results.**

The reasons mentioned therefore are

1. **missing highly resolved data of the structure of the 3-dimensional humidity distribution,**
2. **missing information about the sea and land surface fluxes of latent and sensible heat and**
3. **little information about the flow modification caused by the orography.**



# Scientific Plan

(to be coordinated with MEDEX 2009/2010  
and other German plans)

## 1. Measurement activities:

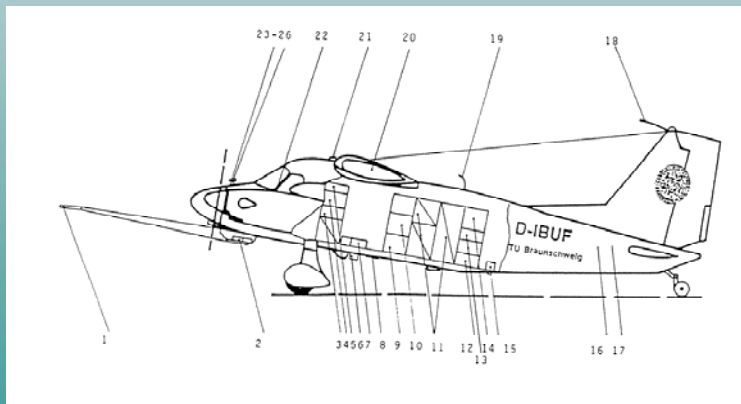
An **airborne measuring program** will provide data for the analysis of the multiscale processes governing the development of a Mediterranean cyclogenesis with embedded convective rain bands. It has to address the higher tropospheric horizontal wind field, the vertical structure of temperature, humidity and wind as well as the sea and land surface fluxes of latent and sensible heat and the modification of the near surface wind field by the orography.

**Aircraft: HALO, DO 128 and dropsondes**



# Dornier 128

## Institut für Flugführung, Universität Braunschweig



No	Unit, Probe	Parameter, Explanations
<b>1</b>	<b>Rosemount 5-Hole Probe</b>	<b>Static pressure, dynamic pressure, differential pressure</b>
2	Rosemount 1221, 1201 Pressure Transducers	Static pressure, dynamic pressure, differential pressure
5	Novatel Differential Receiver	GPS-position and GPS-speed
6	Optech Laser Altimeter	Height
7	Honeywell Lasernav	Pitch, bank, yaw, angular velocities, acceleration, INS-position, ground speed
8	Sperry Radar Altimeter	Radar height
<b>12</b>	<b>KT4-Data Unit</b>	<b>Surface temperature of the earth</b>
<b>15</b>	<b>KT4 Sensor</b>	<b>Surface temperature of the earth</b>
19	Air Inlet	Inlet for trace gas measurements
21	GPS-Antenna	GPS signals
22	Lyman-Alpha Sensor	Humidity of air (fast)
<b>23</b>	<b>Rosemount Temperature Sensor</b>	<b>Temperature of air (slow)</b>
<b>24</b>	<b>Rosemount Temperature Sensor</b>	<b>Temperature of air (fast)</b>
<b>25</b>	<b>Humicap</b>	<b>Humidity of air</b>
<b>26</b>	<b>Meteolabor Dew Point Mirror</b>	<b>Humidity of air</b>

# HALO

- DLR dropsondes
- FZK dropsondes
  - Windlidar
  - Turbulence





# Modeling

**Analysis** of measured Mediterranean **cyclones**.

**Models** used will be **LM/GME** and **KAMM II** (cloud resolving).

The model representation of convection and the interaction between precipitation-related processes on different scales will be investigated. The quality of precipitation forecasts will be compared and if possible improved.

It is planned to have both aircraft available for a

**4 - week period in October - November**

for operation in the **NEPTUN** project if possible **coordinated with THORPEX TReC / MEDEX** experimental activities.



# **Studies of the Effects of Air Pollution on the Formation of the Haze in the Dead Sea Area**

**A Proposal for a coordinated mission of the HALO research aircraft  
in the fields  
“Transport processes and atmospheric dynamics”  
and  
“Radiation and Aerosols”**

by

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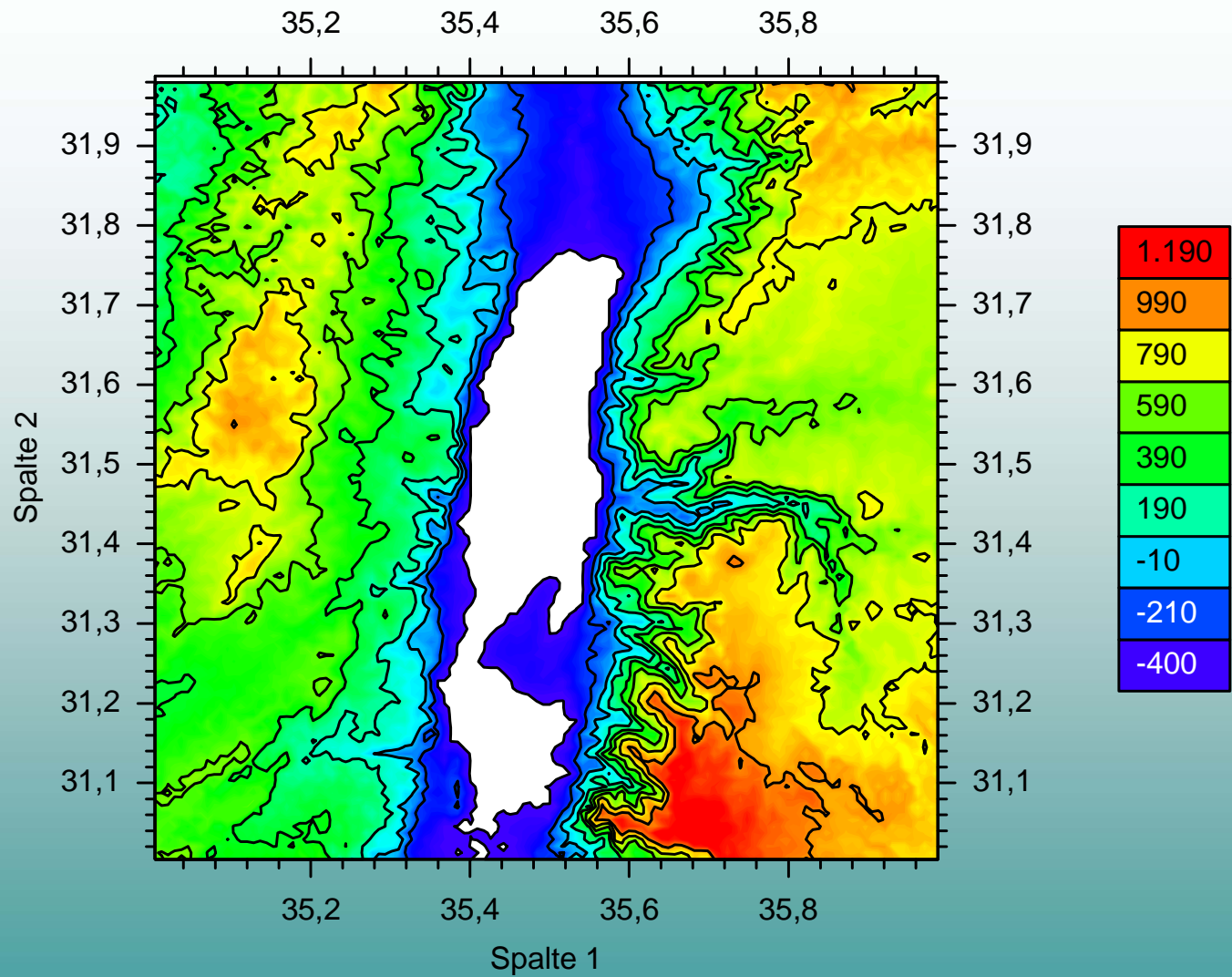


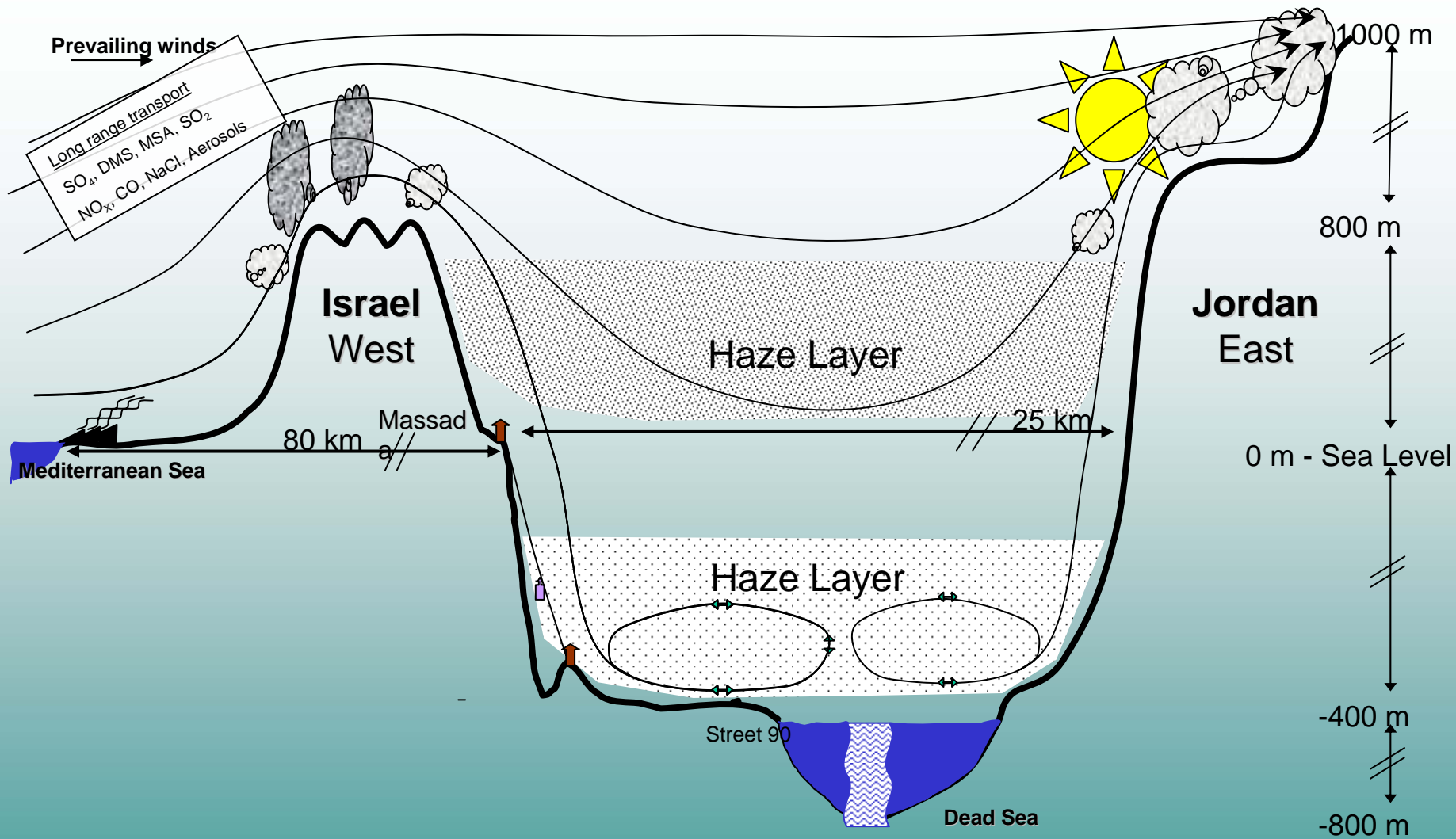
# Scientific Background

- The Dead-Sea has unique medical qualities for the treatment of skin diseases based on minerals and the lower UV solar radiation.
- The appearance of a haze layer over the valley impairs the visibility, and reduces the temperature.
- Not much is known about the haze layer, its sources, composition, and its temporal and spatial variations.
- The particles in the Dead Sea valley originate from near and distant sources.
- In the morning two distinct haze layers are formed over the Dead Sea valley.
- They are different in their composition and originate from two different sources (industrial region south west of the lake and the Israeli coast or even Europe).









Mezoqe Dragot



## Massada pump station at the southern Dead Sea





## Open Questions

- No clear picture of the **sources of the particles** of the different layers.
- Effects of **Wind and Transport** regimes
- Lack of knowlege about the **chemical composition** and aging of **the haze**.
- The **effects of the haze** on the incoming solar radiation.
- The effects of the **incoming UV radiation** on the energy available for **evaporation** in the lake.



# Objectives

1. Numerical investigation of the airflow over the eastern Mediterranean and the Israeli terrain
2. Quantification of gaseous pollutants and aerosol particles taking place during transport.
3. Modelling the impact of aerosol particles on the radiation budget in the Dead Sea area.
4. Investigation of the chemical changes taking place on the haze particles during the day.
5. Modification of the visual range by the anthropogenic haze layers.
6. Quantification of the contributions of different sources to the air pollution in the Dead Sea area



## Planned HALO operations (in 2008)

The project proposed is assigned to the HALO research fields Transport processes and atmospheric dynamics, Radiation and Aerosols.

HALO is equipped with in-situ sensors for high frequent turbulence measurements and a dropsonde system for simultaneous vertical profiling with numerous dropsondes.

Remote sensing (vertical and/or horizontal profiling) of wind, temperature, and humidity will be done using Radar and Lidar systems onboard HALO.

For radiation and aerosol measurements onboard HALO the cooperation with experts from other institutes and research centres in necessary.

