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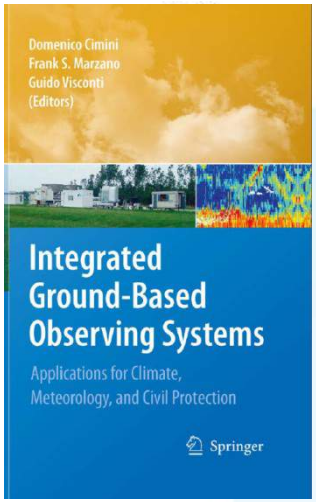
METEOROLOGICAL TEMPERATURE PROFILER

MTP-5

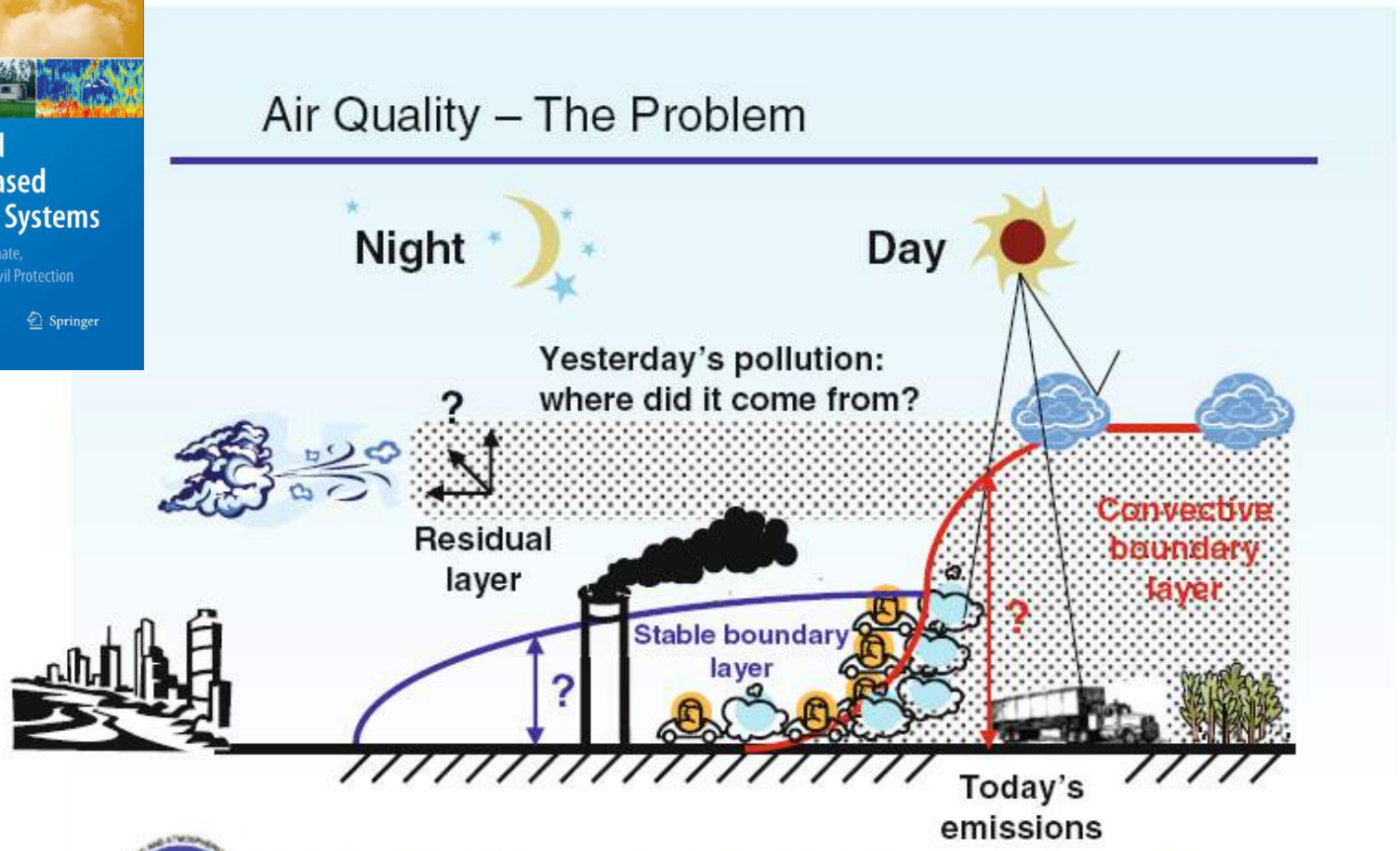
ecology and urban climat

always with a profile

WHY WE NEED TEMPERATURE PROFILE?



J.M. Wilczak et al.



- Vertical mixing: what is the depth of the boundary layer?
- Horizontal transport: where does the wind move the pollution?
- How much pollution is present?

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HOW WE CAN MEASURE THE BOUNDARY LAYER TEMPERATURE PROFILES?

MTP-5 is makes measurements up to 1000 m above the instrument and gives the same performance in all weather conditions. It is compact and operates from 12 VDC. The rotating scanner assembly is protected by a special cover that has very good microwave transmission. The cover sheds precipitation and allows compensation for dirt during the self-calibration. It is:

- **CONTINUOUS MEASUREMENTS,**
- **UNMANNED,**
- **NO CONSUMABLES**

MTP-5 is ideal for use in urban environments, ecology and at airports.

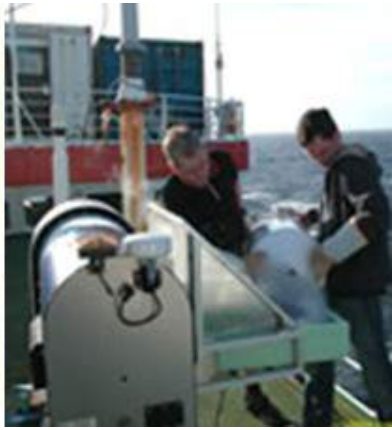
alternatives

1) Radiosonde
does not give the possibility of the continuous measurements, high operational cost

2) MetroTower
strong location restriction, very high cost

3) Tethered Balloons
strong limitation in the weather conditions, high Operational cost

4) RASS is depend on weather condition and there are no data on the first 100m



5) MultiChannel padiometer
No profile without radiosondes (pos.1)

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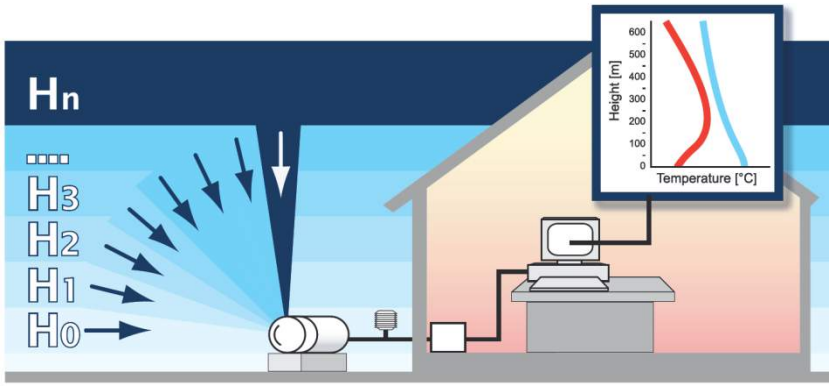
WHY MTP-5? UNMANNED, SELF-TESTED and SELF-CALIBRATED TECHNOLOGY!



An angular-scanning, single-channel microwave radiometer, such as the MTP-5, with its working frequency at the molecular oxygen band centre can provide continuous measurement of ABL temperature profiles practically in all weather conditions. For altitude up to about 1 km, the accuracy of temperature profile recovery is about 0,2-1.2C (depend on type of profile). MTP-5 data are very useful for many applications: forecasting of air pollution at urban area, mesoscale weather forecasting, forecasting of dangerous meteorological conditions, investigation of urban heat island, etc.

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WHY MTP-5? EXPERIENCE!

Since 1992 about **93** devices in **14** countries are working to measuring of the temperature profiles. During 1995-2010 we have developed and done promotion of MTP-5 with support **Kipp&Zonen**. About **30** of them in Russia. For such routine tasks as Meteorological service with nowcasting and short forecasting

Moscow region.
Russian 2003

Turin.
Italy

Alaska.
USA

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WHY MTP-5? ACCURACY!

Altitude range	1000 m
Displayed height interval H version HE version	50 m in range 0÷1000 m 25m in range 0÷100 m 50m from 100 to 1000m
Measurement interval, minimum	5 minutes
General measurement frequency	56,6 GHz
Field of view	2.5º
Accuracy of temperature profile RMS T[C]	0.2÷ 1.2 or better (depend on type of profile)
Accuracy in determination of the height %	25%
Weight	20 kg
Power consumption	Maximum 12 VDC/not more than 100 W average 60 W
Power requirements AC/DC power supply	220 VAC/ 110 VAC, 1A/ 2A, 50 - 60 Hz
Ambient temperature range	-40 °C - +50 °C
Calibration	self calibrating

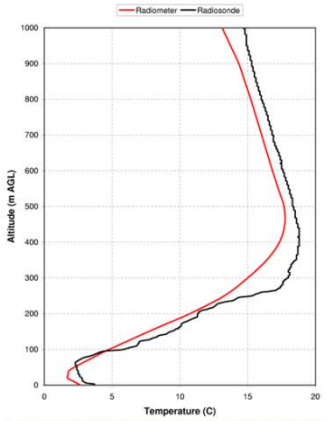
The Federal Service for Hydrometeorology and Environmental Monitoring (ROSHYDROMET)

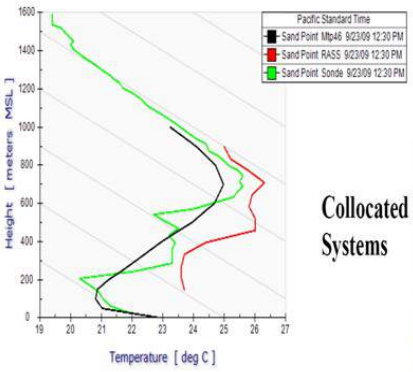
The Federal State Institution "The Russian Federation Hydrometeorological Research Center

The Federal State Budgetary Institution "Central Aerological Observatory"

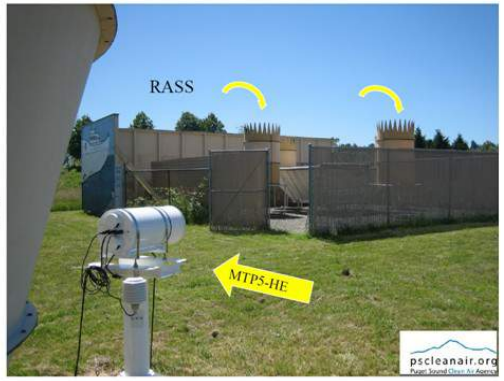
Methodology Recommendations
for the use of data from MTP-5 profiler

Member of HMEI





Collocated Systems



Example with RASS comparisons

ФЕДЕРАЛЬНОЕ АГЕНТСТВО
ПО ТЕХНИЧЕСКОМУ РЕГУЛИРОВАНИЮ И МЕТРОЛОГИИ

СВИДЕТЕЛЬСТВО

об утверждении типа средств измерений

RU.C.32.002.A № 45688

Срок действия до 12 марта 2017 г.

НАИМЕНОВАНИЕ ТИПА СРЕДСТВ ИЗМЕРЕНИЙ
Профилемеры метеорологические температурные МТР-5

ИЗГОТОВИТЕЛЬ
Общество с ограниченной ответственностью "Научно-производственная организация "Атмосферные технологии" (ООО "НПО "АТТЕХ"),
г. Долгопрудный, Московская обл.

РЕГИСТРАЦИОННЫЙ № 49208-12

ДОКУМЕНТ НА ПОВЕРКУ
АТМР 416311.001 МП

ИНТЕРВАЛ МЕЖДУ ПОВЕРКАМИ 2 года

Тип средств измерений утвержден приказом Федерального агентства по техническому регулированию и метрологии от 12 марта 2012 г. № 138

Описание типа средств измерений является обязательным приложением к настоящему свидетельству.

Заместитель Руководителя Федерального агентства Е.Р.Петросян

26 03 2012 г.

Серия СИ № 003771

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METEO SERVICE NOWCASTING,

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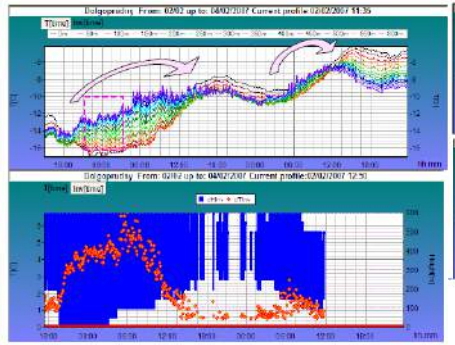
and Environmental Monitoring (ROSHYDROMET)

The Federal State Institution "The Russian Federation Hydrometeorological Research Center

The Federal State Budgetary Institution "Central Aerological Observatory"

Methodology Recommendations
for the use of data from MTP-5 profiler

Moscow, 2010



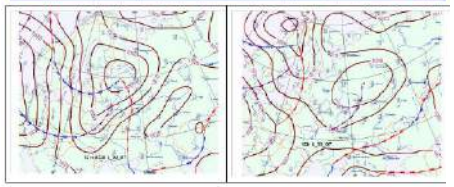


Fig. 5. An example of mixed advection-radiation temperature inversion and weather map for one episode. The first heat wave (the pink arrow in the upper picture) persisted for 12-14 hours with a temperature rise by about 3°C throughout the measurement layer. Against the background of the nighttime temperature increase with low wind the lower inversion boundary descended to the ground due to

11

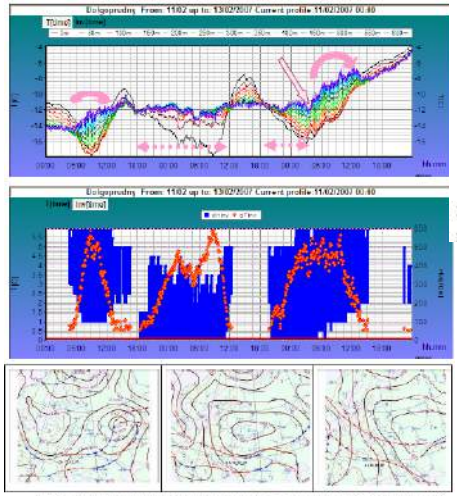


Fig.17. Advection, radiation and mixed-type inversion in a temperature field (the upper picture) and inversion parameters (the middle picture: inversion magnitude shown by the red line, inversion layer colored blue). *Initially, on the 11.02 episode, a nighttime advection inversion with turbulent oscillations in the upper measurement layer portion (round arrow) was observed. During the next night, conditions developed that favored underlying surface cooling and surface inversion formation, the latter destroyed at about 11:00 of 12.02. In the evening that day, conditions favorable for cooling were still preserved, and at about 19:00 radiation temperature inversion began to form. In the morning of 13.02, at about*

25

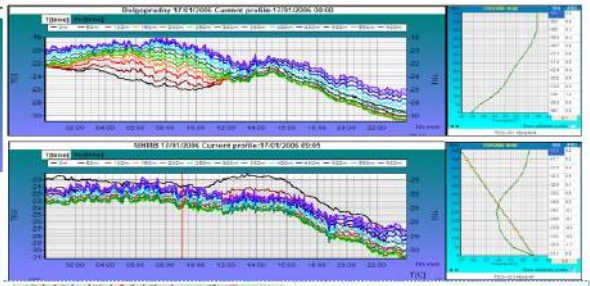


Fig.18. Simultaneous temperature measurements in the lower 600-m layer in Dolgoprudny, north of Moscow (the upper picture) and in Moscow center (below). *At night, surface inversion with a maximum magnitude of 5-6°C developed (the upper profile). In the center of Moscow, conditions favoring convection mixing persisted throughout the night; the lower inversion boundary was at a 300-m level (the lower profile), the inversion magnitude in the measurement layer being about 3°C. The large difference in the thermal structure of the lower atmospheric layer between locations 26 km apart is the result of Moscow thermal*

Fig. 24 An abnormal diumal variation of thermal stratification (grey contour) caused by the advection of polluted air from forest and steppe fires in a warm cyclone sector. August 2008. *An abnormally stable*

Fig. 25 Icing conditions (blue contour): during 08:00 - 12:00 and 19:00 - 22:00 periods, the temperature in the surface layer is below 0°C , while in the layer above (300-600m) it is above 0°C. During a 14:00 – 18:00 period, the conditions are favorable for liquid precipitation formation. (Dashed line indicates 0°C).

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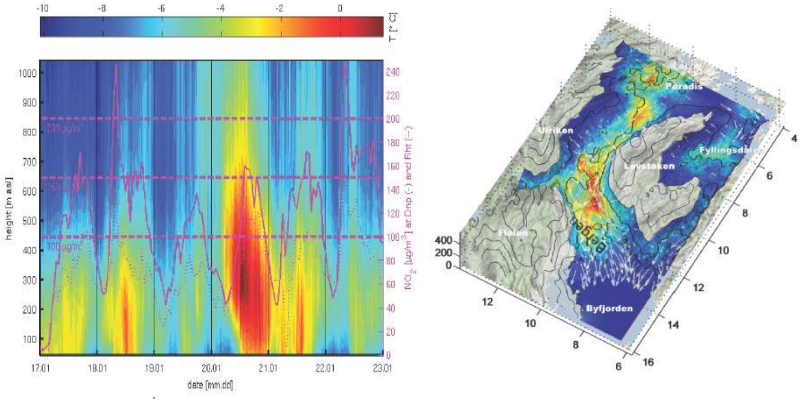
METEO SERVICE: MODELING and FORECAST

Modelling of Air pollution in Bergen City

Igor Esau & Tobias Wolf, GC RieberPhD Fellow



*(a) MTP vertical temperature profile and [NO^2] at Danmarksplass and **Rådhuset** for 7 days in January 2013; (b) Simulation of the air pollution (red color) with the PALM model at 30 m spatial resolution.*

METEO SERVICE: MODELING MODELING**:**

PALM Nansen Environmental and Remote Sensing Center, Norway

WRF Moscow State University, Central aerological observatory

COSMO Hydrometeological centre of Russia

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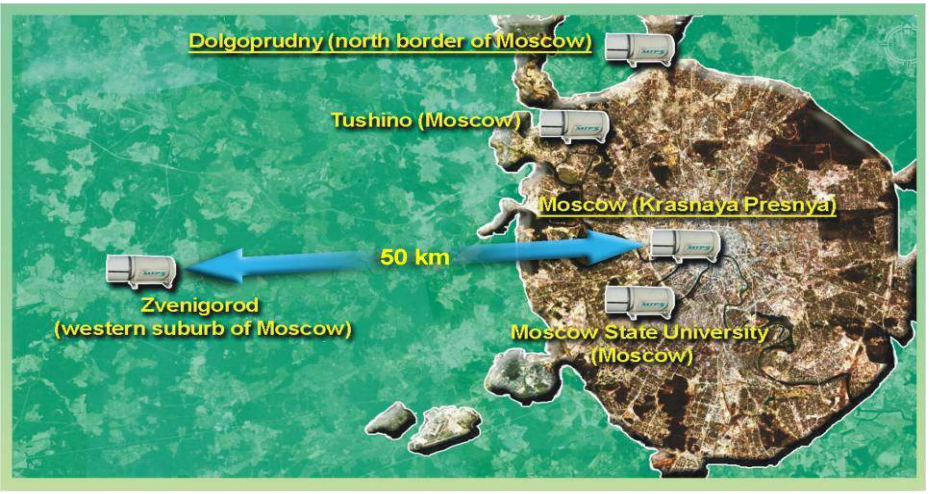
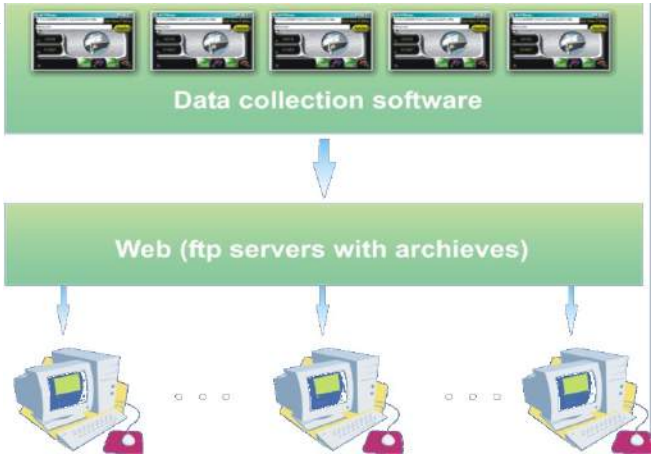
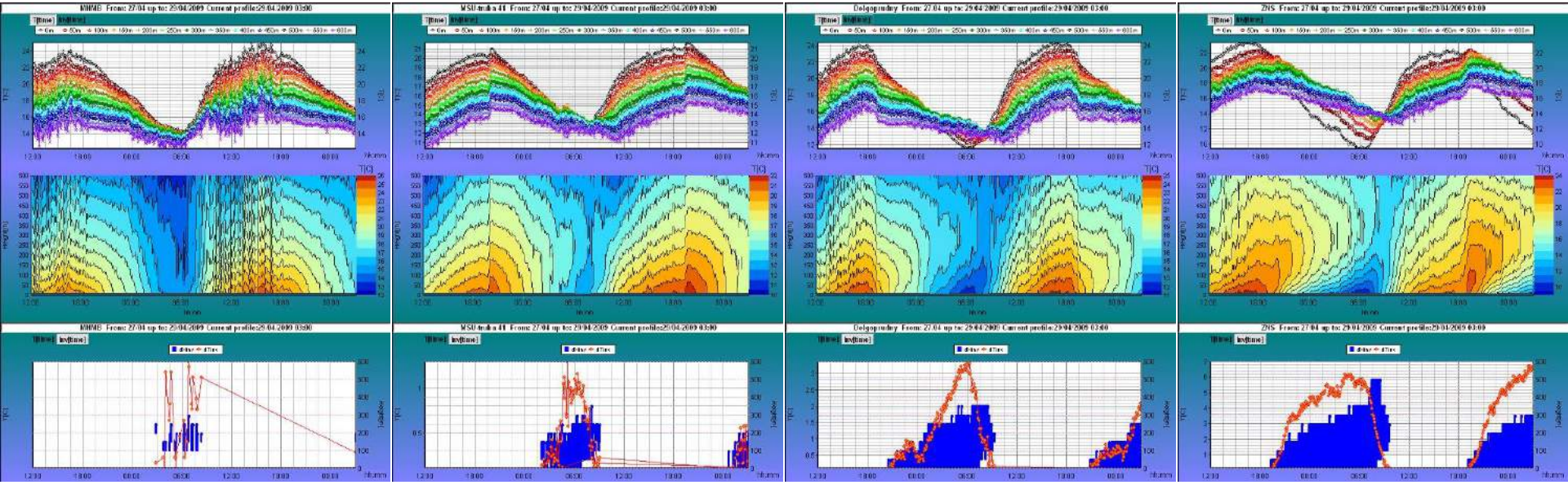
URBAN CLIMATE: ECOLOGY, FORECAST, HEAT WAVE and etc





Regional and federal meteorological and ecological services



Moscow (Krasnaya Presnya) **MSU (Moscow)** **Dolgoprudny** **Zvenigorod**

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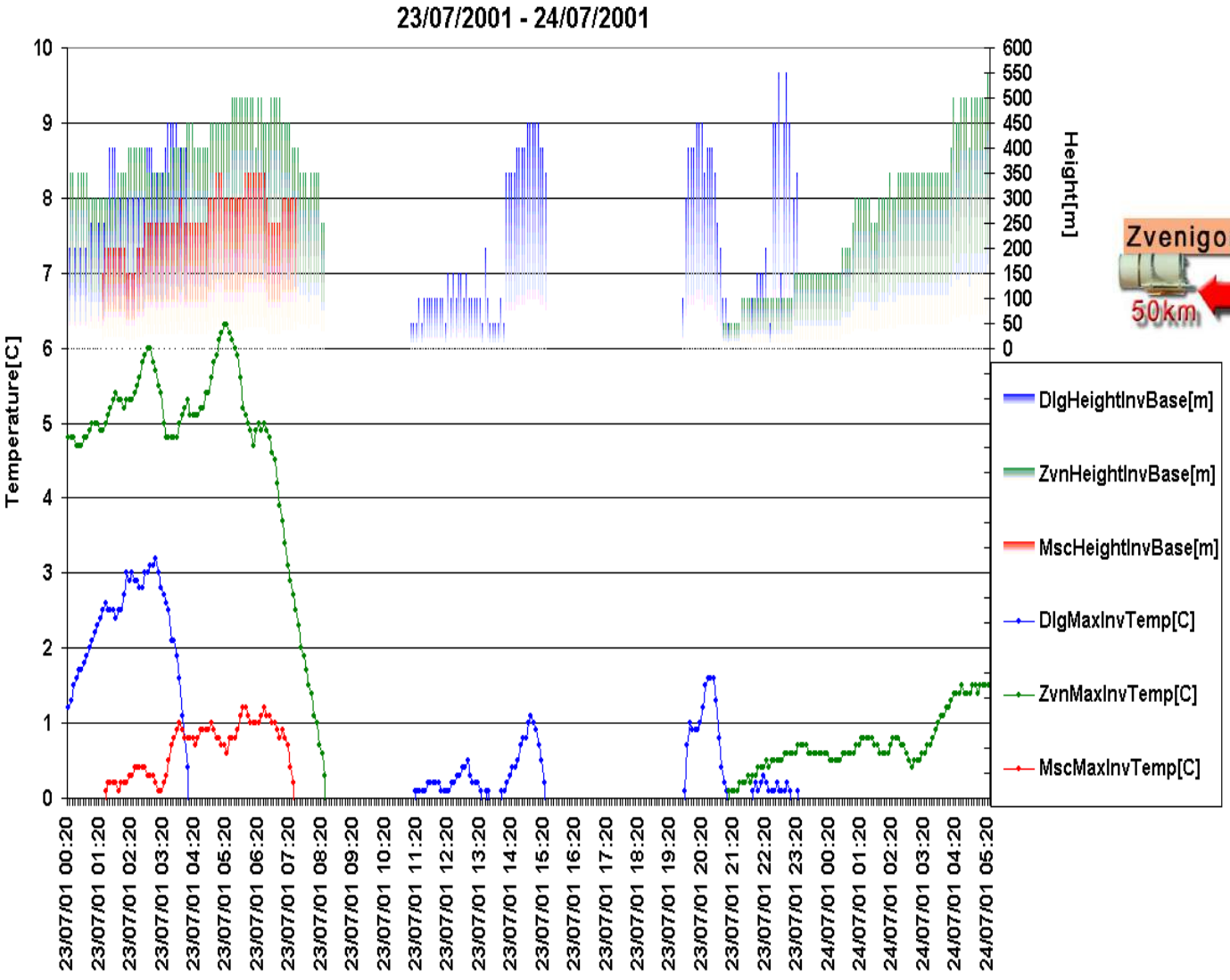
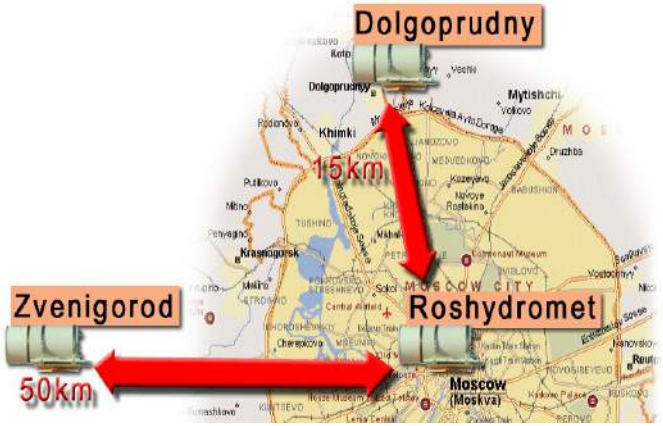
URBAN CLIMATE: ECOLOGY, FORECAST, HEAT WAVE and etc





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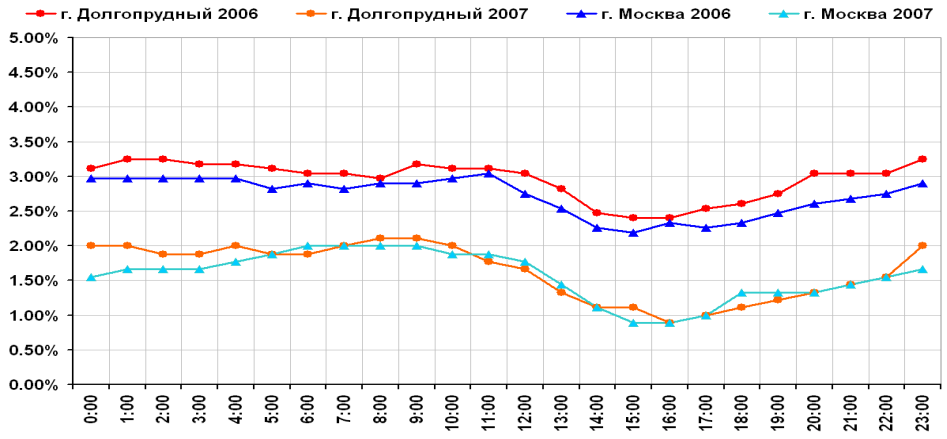
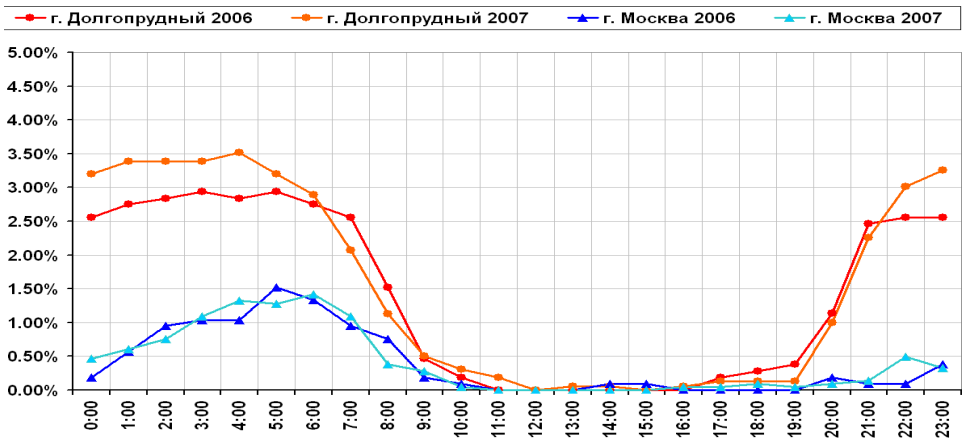
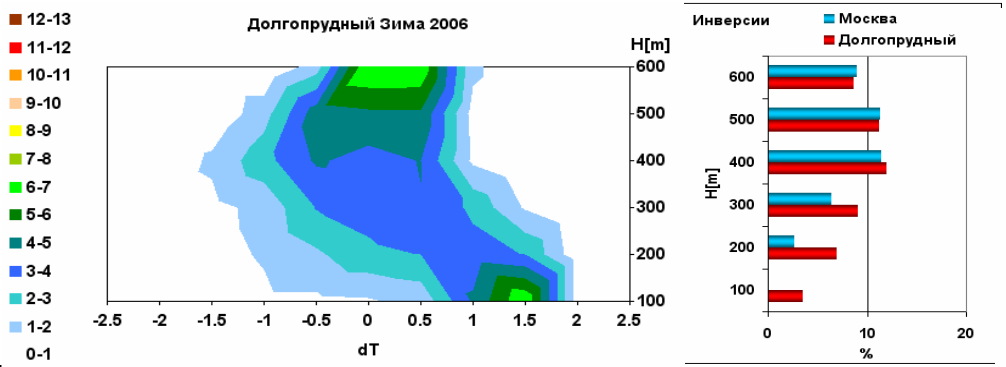
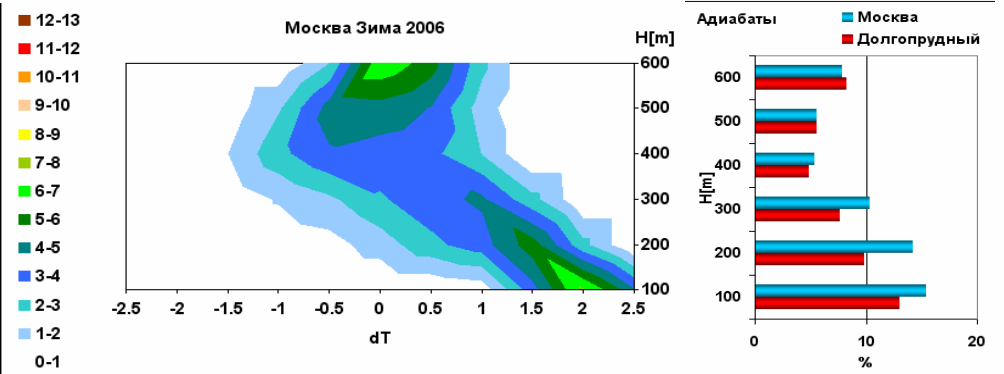
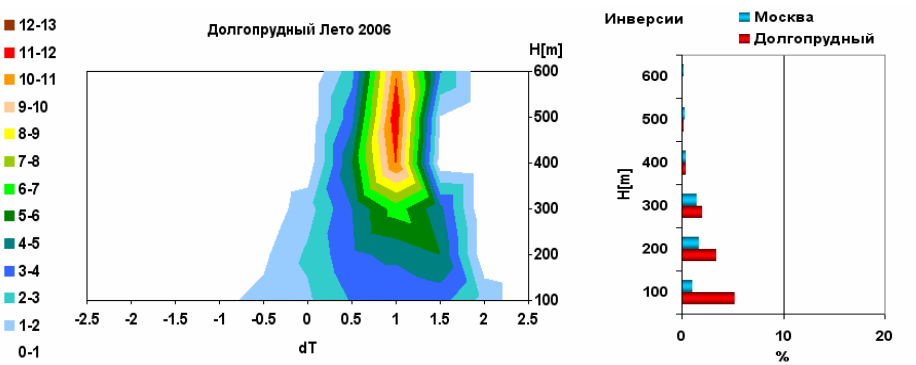
URBAN CLIMATE: ECOLOGY, FORECAST, HEAT WAVE and etc

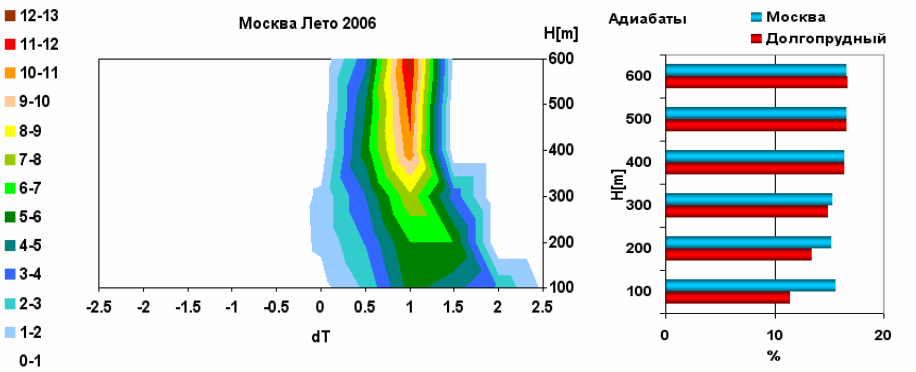


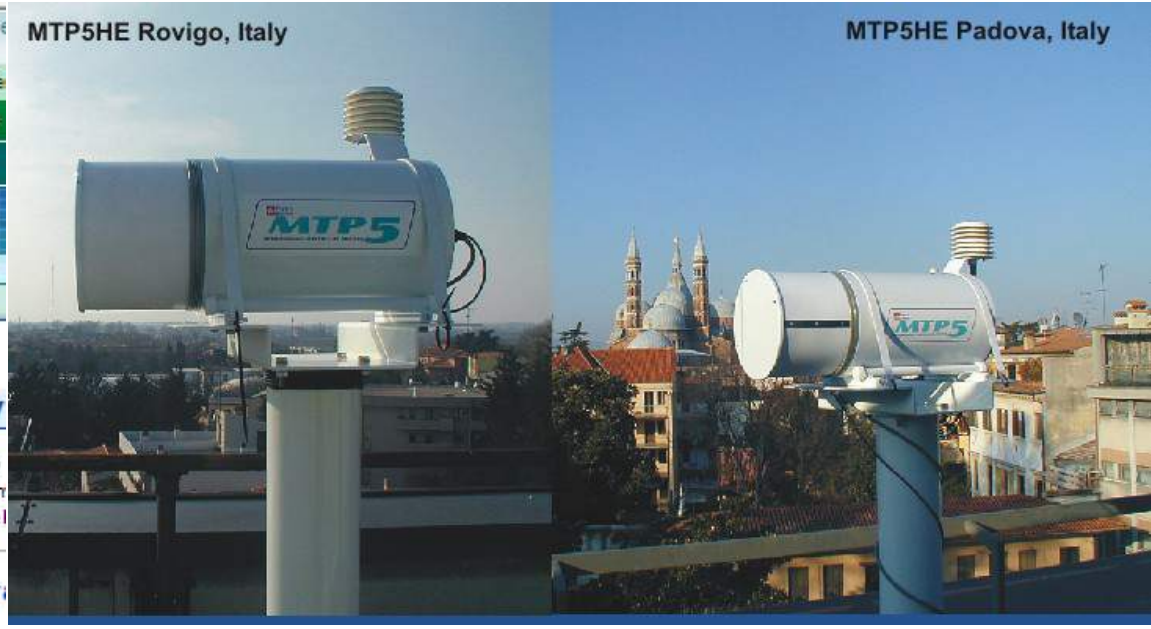










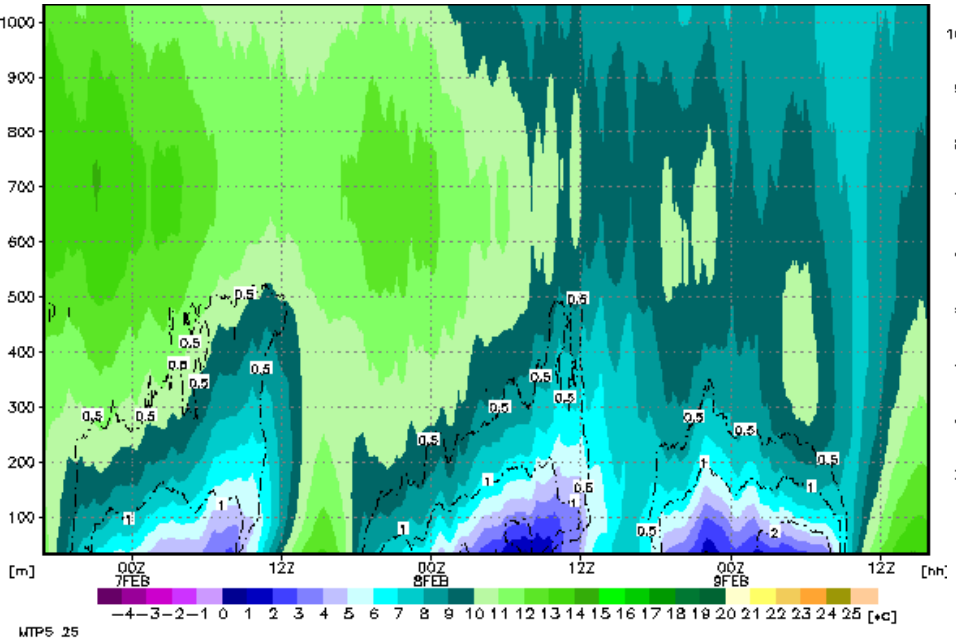


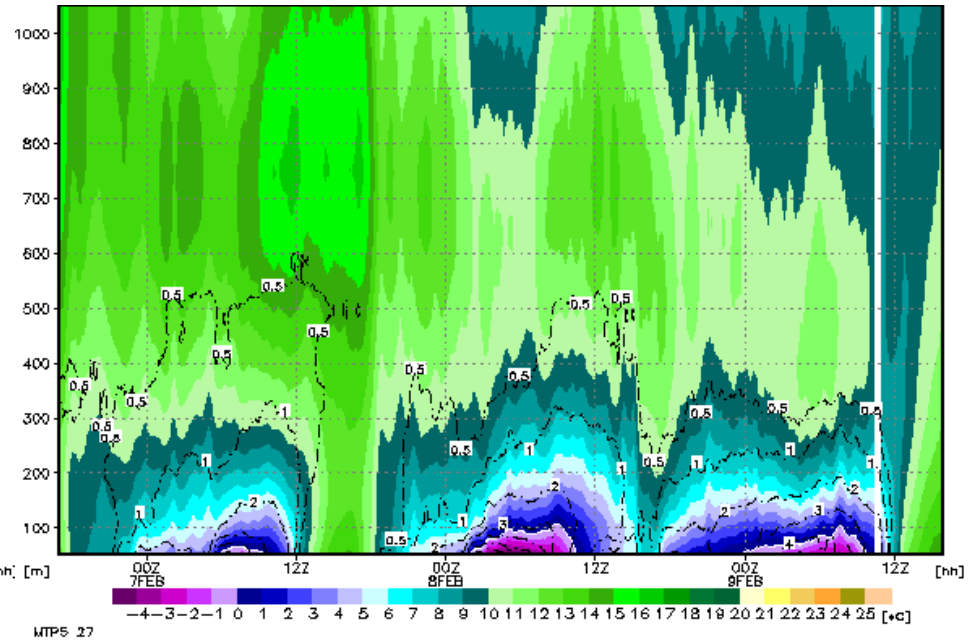
http://www.arpa.veneto.it/bollettini/htm/profilatori.asp

Padova tetto del Dipartimento

40km

Rovigo palazzo della Regione





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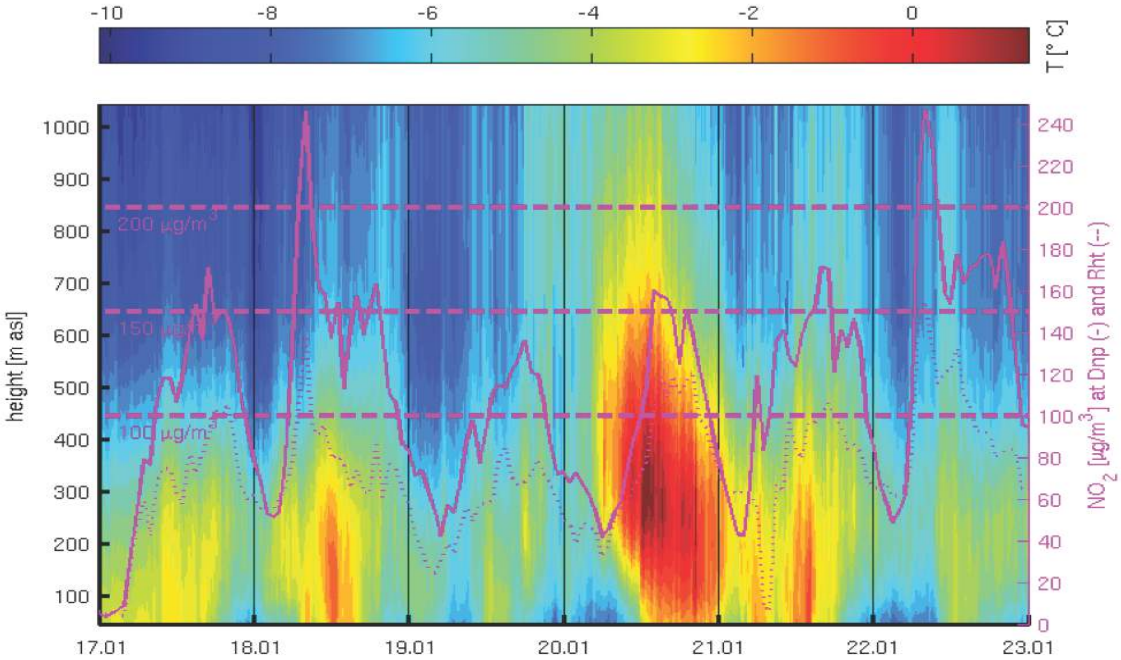
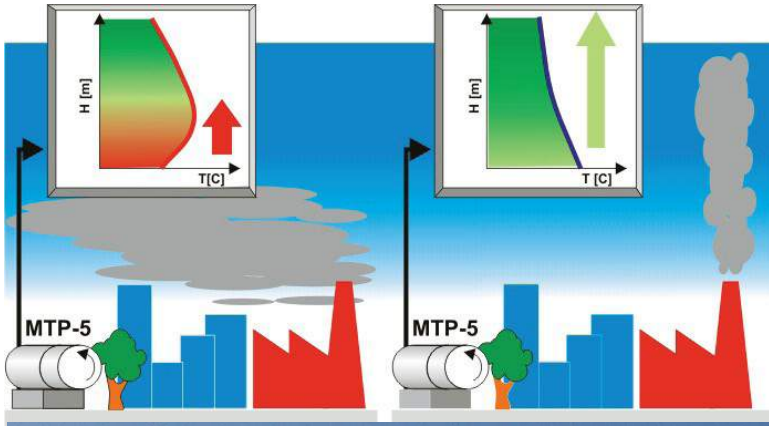
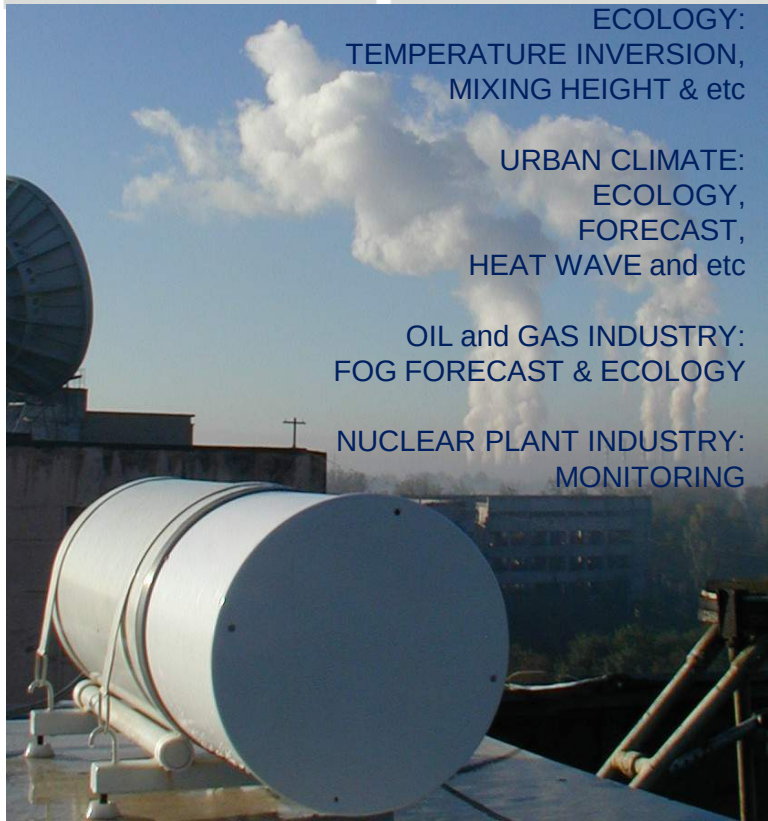
APPLICATIONS for ECOLOGY

MTP 5 has an important application in monitoring air pollution. It offers a simple, fast and economical solution for forecasting and for the process of issuing public information. Also it can be used to help predict the dispersion of gasses in the case of accidental or unscheduled releases. The illustrations (on right) show relative levels of air pollution. In the case of a temperature inversion (red), typically in the early morning, the gasses and aerosols are trapped close to the ground. During the day, the profile becomes adiabatic (green) and the pollution concentration decreases as the gasses and aerosols escape to higher levels.



MTP vertical temperature profile and [NO2] at Danmarksplass and Rådhuset for 7 days in January 2013 (Modelling of Air pollution in Bergen City Igor Esau & Tobias Wolf, GC Rieber PhD Fellow , Annual Report 2012, Nansen Environmental and Remote Sensing Center,Bergen – Norway, affiliated with the University of Bergen





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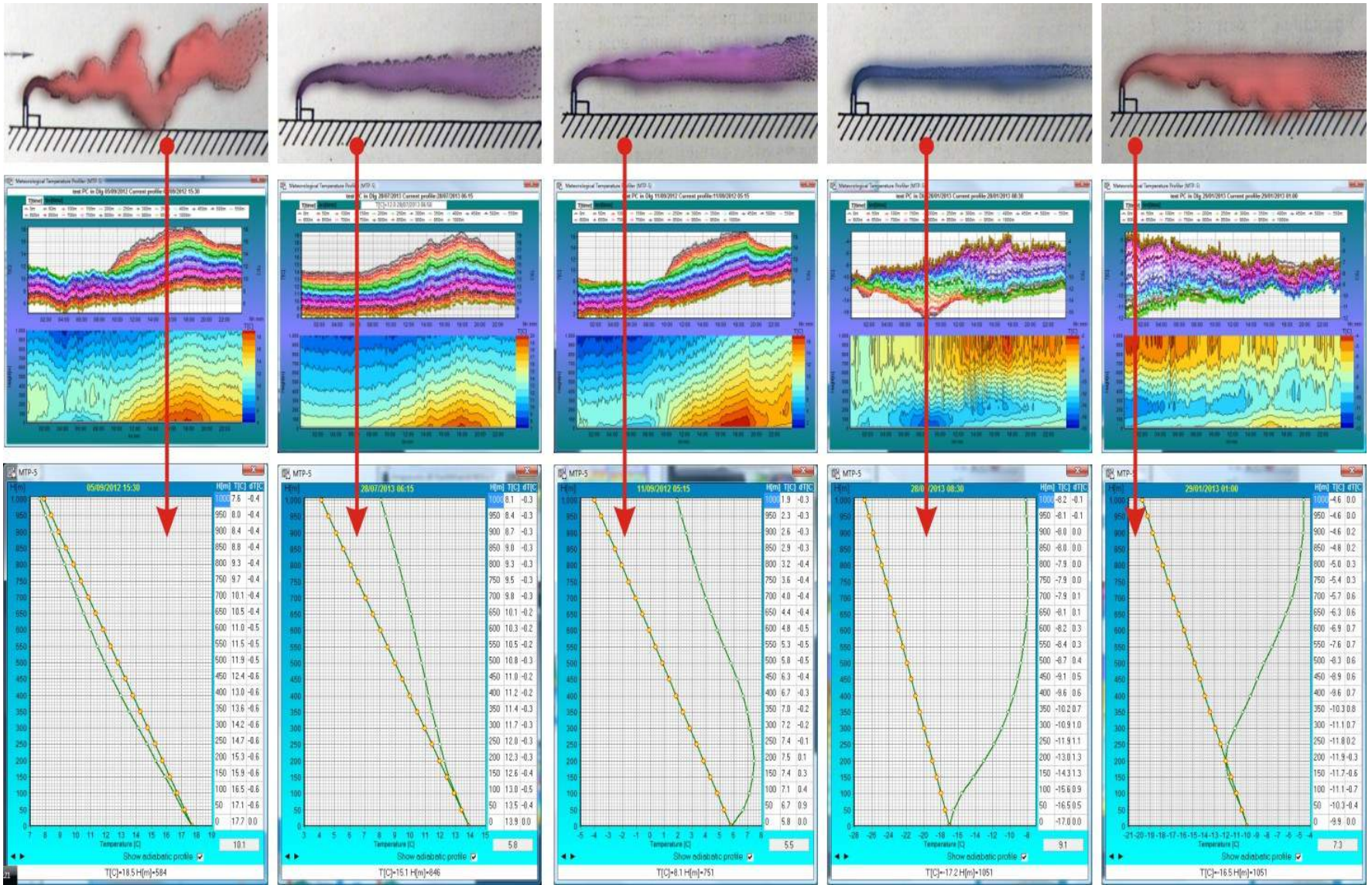
Environmental services: air pollution forecast and warning



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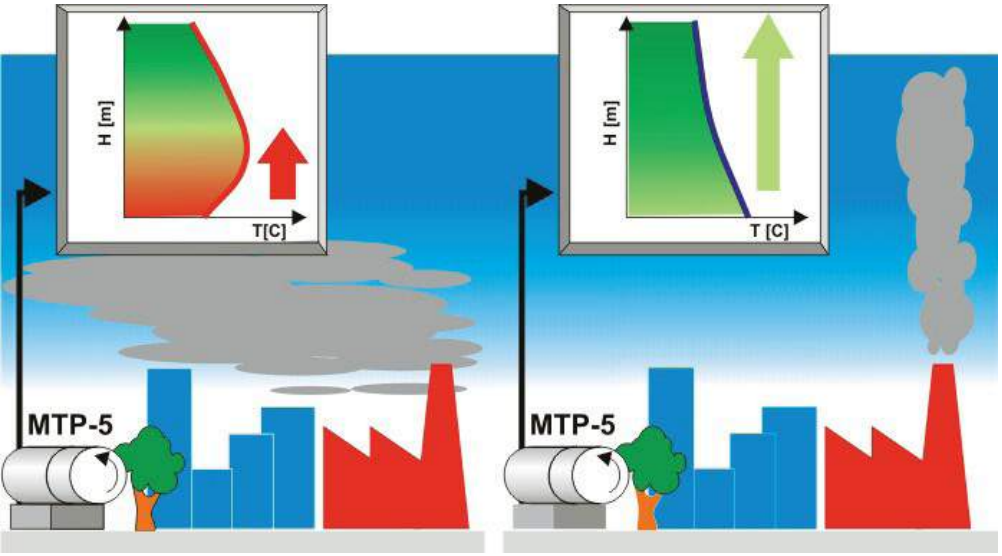
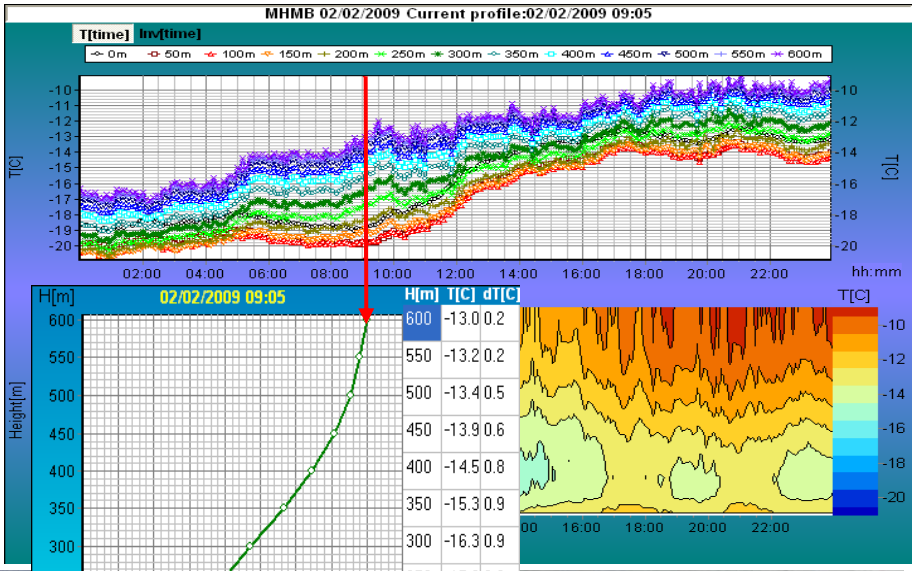
WHY WE NEED TEMPERATURE PROFILE?





Moscow 02.02.2009

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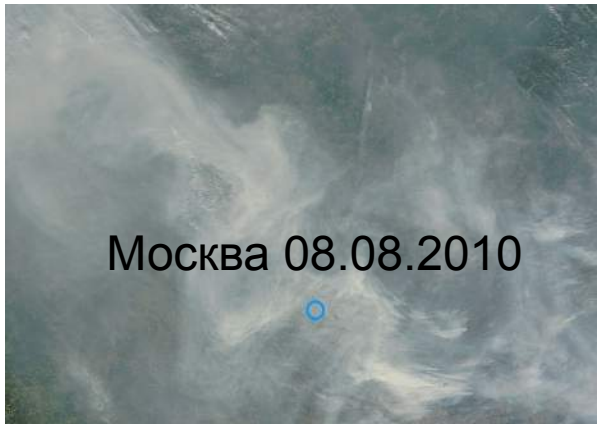
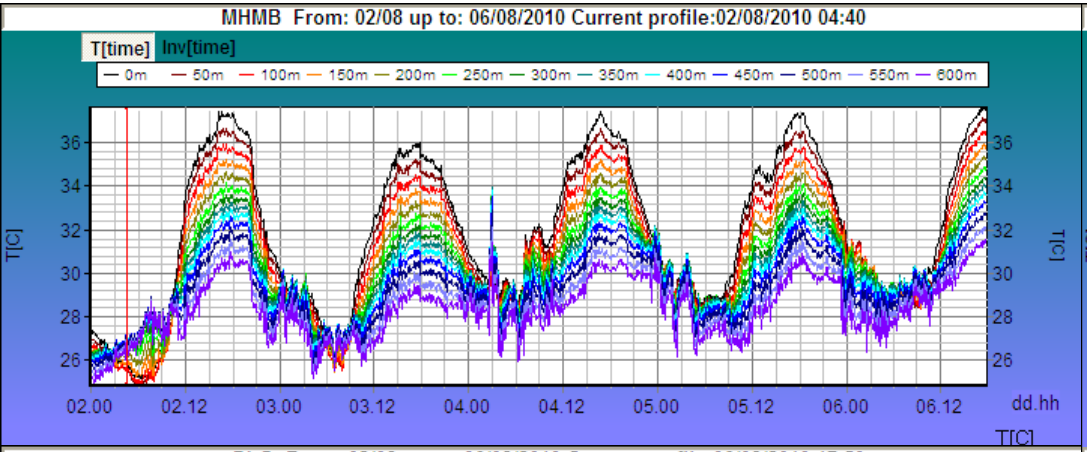
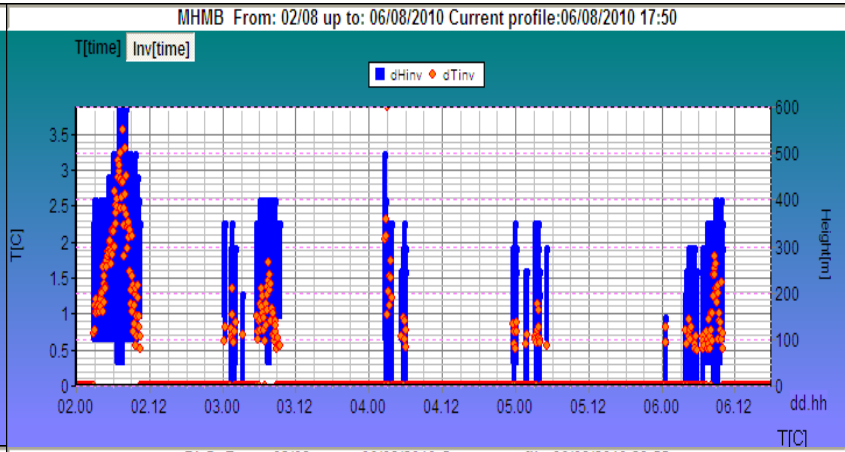
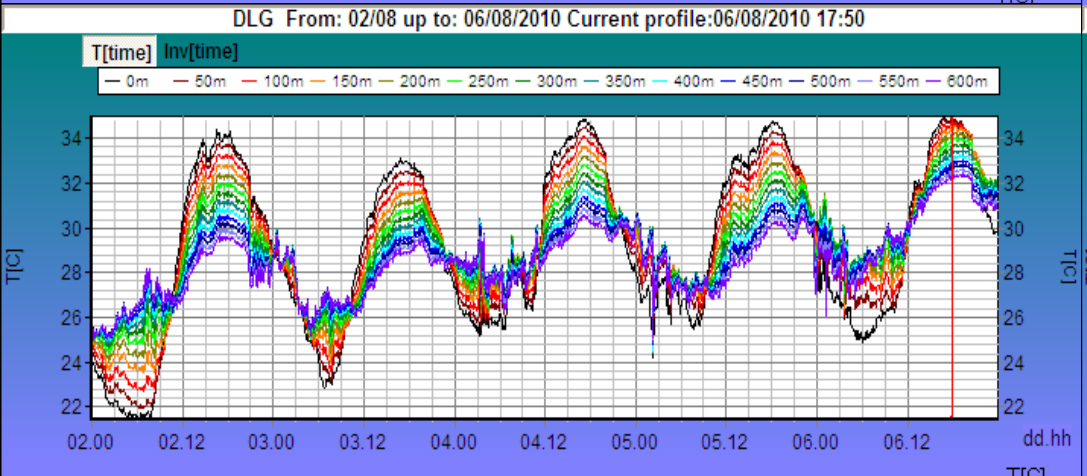
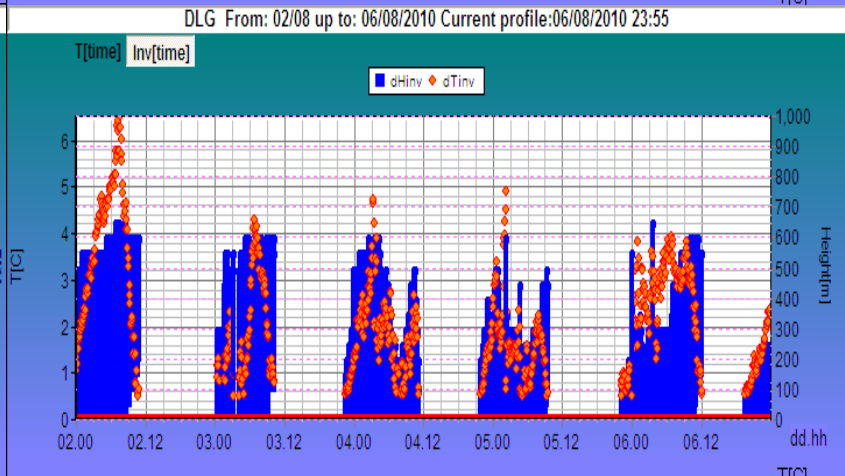
URBAN CLIMATE: ECOLOGY

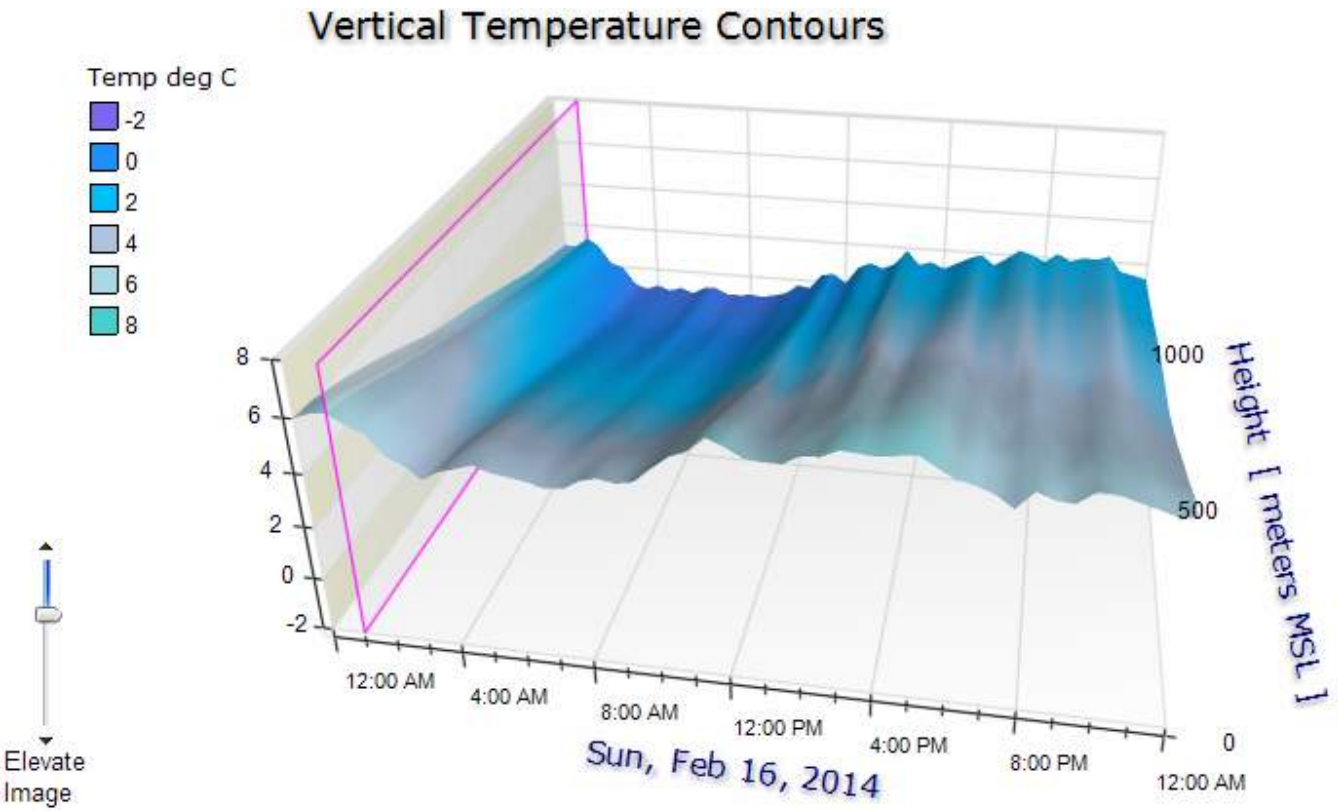


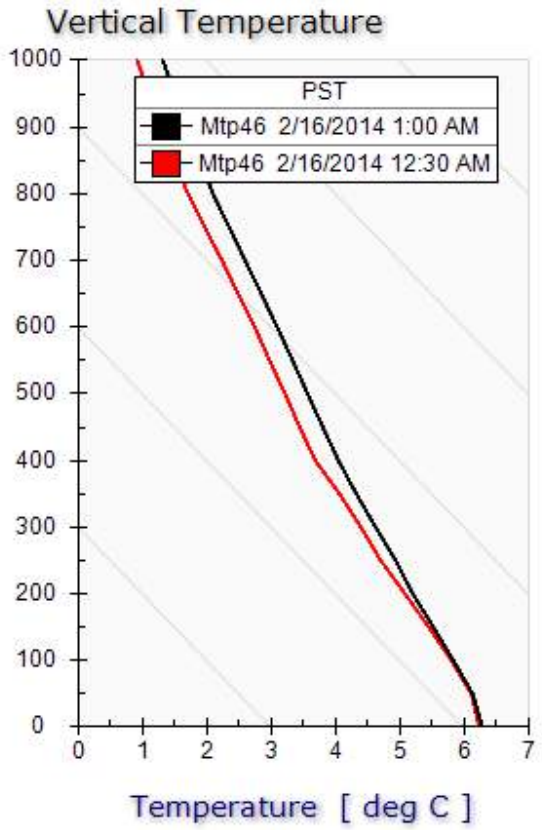












Elevate Image

Rotate Image

Display # Days

1 2 3

Change Start Day

-1 day +1 day

Start time

2/16/2014 12:00 AM

End time

2/17/2014 12:00 AM

<------- Change Time Slice View ------->

- Single station w/ multiple time plots
- Multiple stations w/ same time plot
- Single station 2D flat contour plot
- Single station 3D surface plot

Mtp5 Sn46	Marysville
Profiler RASS	Seattle Sand Point

pscleanair.org
Puget Sound Clean Air Agency

- Hour only values
- Every 30 minutes

Plot Information

View Grid of Plotted Data

Create Data File

Download File

MTP-5 METEOROLOGICAL TEMPERATURE PROFILER

RPO ATTEX
rpo.attex@gmail.com
www.attex.net

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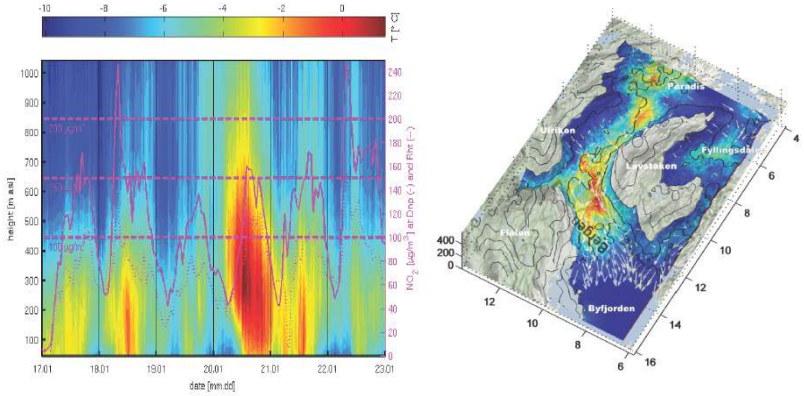
Company's history of / effort of validation/data QA

2003 3 MTP-5 Taipei, Taichung and Kaohsiung EPA Taiwan
2012 Nansen Environmental and Remote Sensing Center, Norway
2007 3 MTP-5, Padova, Rovigo and Belluno. Regional Agency of Environmental Protection of Veneto - Centro Meteorologico Teolo (ARPAV/CMT)

Modelling of Air pollution in Bergen City
Igor Esau & Tobias Wolf, GC RieberPhD Fellow



(a) MTP vertical temperature profile and [NO²] at Danmarksplass and Rådhuset for 7 days in January 2013; (b) Simulation of the air pollution (red color) with the PALM model at 30 m spatial resolution.

CLIMATOLOGY OF THE STATIC STABILITY OF THE NIGHT-TIME PO VALLEY PBL FROM RADIO SONDES AND PASSIVE MICROWAVE RADIOMETERS

Massimo E. Ferrario, Andrea M. Rossa, Maria Sansone, and Marco Monai

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Two-year Microwave Radiometric Observations of Low-level Boundary-layer Temperature Inversion Signatures

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WHY MTP-5? EXAMPLES OF THE DATA!