



MTP-5 METEOROLOGICAL TEMPERATURE PROFILER

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Research-and-production organization "Atmospheric Technologies"



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Meteorological temperature
profiler MTP-5 applications
for aviation industry

METEOROLOGICAL TEMPERATURE PROFILER

MTP-5



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WHY WE NEED TEMPERATURE PROFILE?

Such weather hazards as

- Wind shear
- Turbulence
- Fog

depend on the type of the temperature profiles and dynamics of this one.

“Weather hazards have a significant negative impact on aircraft safety. Based on recent surveys, 20–30% of worldwide air accidents are due to adverse weather conditions.

In Europe, as much as 22% of air traffic delays are due to bad weather. The problem is that the latest trends estimate that air traffic will increase by a factor of three within the next 20 years.

Weather hazards have a significant negative impact on aircraft safety. The use of ground-based remote sensing instruments can help to mitigate these hazards by observing the weather phenomena associated with these hazards. By using data fusion from several instruments or algorithms, it is possible to better identify and nowcast them to improve airport terminal area security. Several important application projects have been pursued in the last decade to tackle with these problems, and the use of ground-based remote sensing instruments was almost always included.”

(Christian Pagé

D. Cimini et al. (eds.), *Integrated Ground-Based Observing Systems*).



Rome. Italy. 2009



Zurich. Swiss 2004



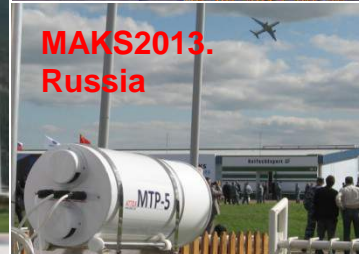
Bolzano. Italy. 2011



Tomsk. Russia 2012



JFK. USA 2012



MAKS2013. Russia



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WHY WE NEED TEMPERATURE PROFILE for Wind shear?

Doc 9817
AN/449



Manual on Low-level Wind Shear

Approved by the Secretary General and published under his authority

First Edition — 2005

International Civil Aviation Organization

3.1.5 An extreme case of the stable condition, which can involve the entire friction layer, occurs when the stability is so marked (e.g. due to the formation of a strong low-level radiation inversion at night) that turbulent mixing and momentum transfer from the large-scale flow above the inversion cease. This results in surface winds becoming light or calm, and as the wind flow at the top of the inversion is effectively cut off from the retarding effects of friction at the surface, a wind speed maximum develops at the top of the inversion (see Figure 3-1 b)).^{4,5} Under certain circumstances, for example, if the airstream is deflected across broad plains by a mountain chain, the wind speed maximum is concentrated into a comparatively narrow band resembling a jet stream. Such wind speed maxima are commonly referred to as "low-level jet streams". Because the maximum speed can exceed 120 km/h (60 kt), the description seems fitting. This terminology was first used to describe the jet-like low-level wind maxima frequently encountered over the Great Plains and elsewhere in the United States, in Scandinavia and along the east coast of Saudi Arabia. In these circumstances the shear below the jet can be significant and is proportional to the strength of the inversion.⁶ The level of maximum wind is generally below 500 m (1 600 ft) and therefore of considerable interest to aviation.

MTP-5 has been developed for temperature inversion measurements!

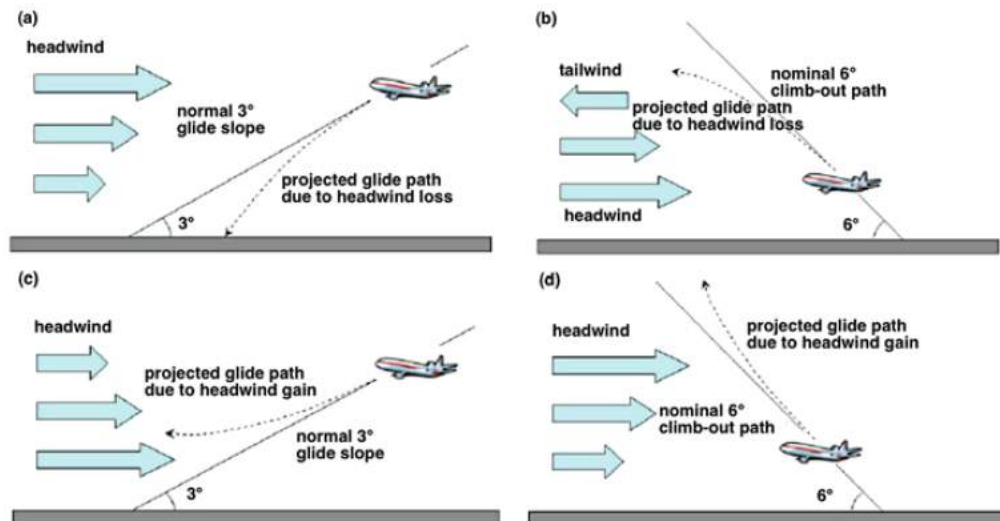


Fig. II.2.9 Vertical wind shear: problems for aircrafts (figure courtesy of Hong-Kong Weather Service)

Christian Pagé D. Cimini et al. (eds.), *Integrated Ground-Based Observing Systems*



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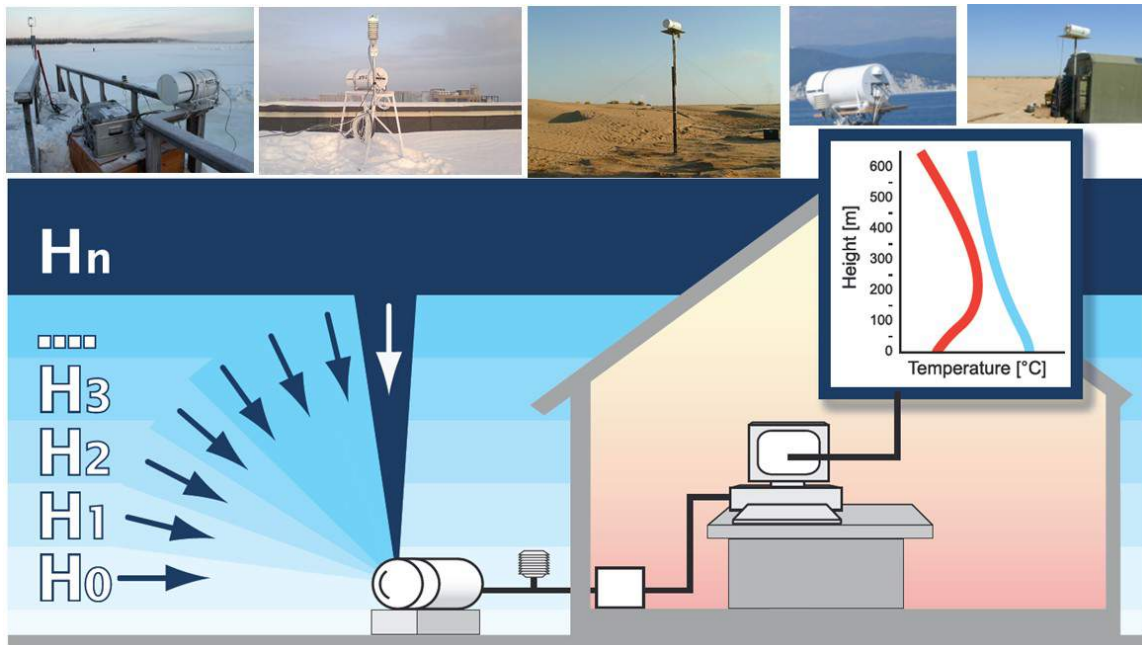
WHY MTP-5? UNMANNED, SELF-TESTED and SELF-CALIBRATED TECHNOLOGY!

MTP-5 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 and at airports.

alternatives



1) Radiosonde

Is limited for using in airport (not continuous)



2) MetroTower

Is impossible in airport

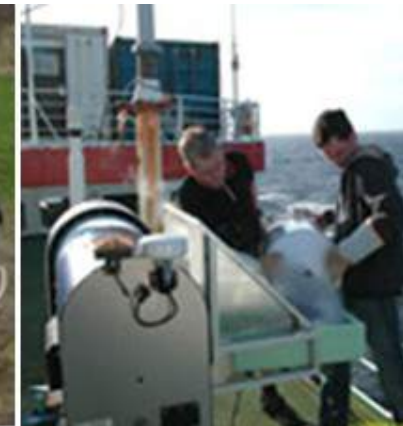


3) Tethered Balloons

Unavailable at airports



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



5) MultiChannel radiometer

No profile without radiosondes (pos.1)



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WHY MTP-5? ACCURACY!



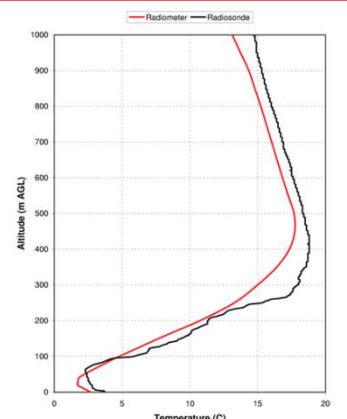
Altitude range	1000 m
Displayed height interval	H version: 50 m in range 0÷1000 m HE version: 25m in range 0÷100 m 50m from 100 to 1000m
Measurement interval, minimum	5 minutes
General measurement frequency	56,6 GHz
Field of view	2,5°
Accuracy of temperature profile RMS T[C]	0,2÷1,2 or better (depend 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	220 VAC/ 110 VAC, 1A/ 2A, 50 - 60 Hz
AC/DC power supply	
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**
CE

Declaration of Conformity

We: R.P.O. ATTEX Ltd.
7 Zavodskaya St.,
Dolgoprudny,
Moscow Region 141700
Russia

declare under our sole responsibility that the product:

Name: **MTP 5 Meteorological Temperature Profiler**
Types: **MTP 5-II, MTP 5-HE and MTP 5-PE**

to which this declaration relates is in conformity with the following European, harmonized and published standards at the date of this declaration:

Emission: EN 61326 (1997) + A1 (1998) + A2 (2001) + A3 (2003)
EN 61000-3-2 (2000)
EN 61000-3-3 (1995) + A1 (2001)

Immunity: EN 61326 (1997) + A1 (1998) + A2 (2001) + A3 (2003)

following the provisions of the Directive:

EMC Directive 89/336/EEC and amendment 93/68/EEC to the above Directive

These conclusions are based upon test reports:

07C00570LBS01
D.A.R.E.!! Consultancy, Woerden, The Netherlands

Dolgoprudny, 01 November 2010

Yuriy Agapov
Director
R.P.O. ATTEX Ltd.

ФЕДЕРАЛЬНОЕ АГЕНТСТВО ПО ТЕХНИЧЕСКОМУ РЕГУЛИРОВАНИЮ И МЕТРОЛОГИИ

СВИДЕТЕЛЬСТВО

об утверждении типа средств измерений

RUC.32.002.A № 45688

Срок действия до 12 марта 2017 г.

НАИМЕНОВАНИЕ ТИПА СРЕДСТВ ИЗМЕРЕНИЙ
Профилеры метеорологические температурные MTP-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

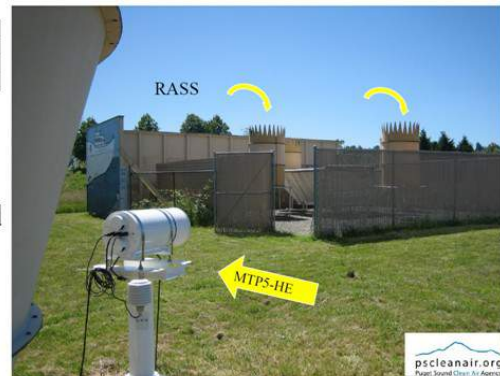
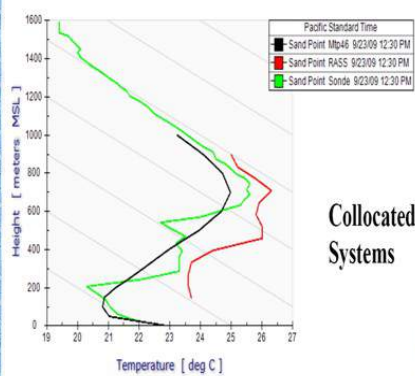
ИНТЕРВАЛ МЕЖДУ ПОВЕРКАМИ 2 года

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.П. Петросьян

№ 003771



Example with RASS comparisons



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WHY MTP-5? EXPERIENCE!



Since 1992 about **73** devices in **11** 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



Rome. Italy. 2009
Aeroporto Fiumicino



 Atmospheric Systems Corporation
Setting the Standard in Sodar
<http://www.minisodar.com/>



Zurich. Swiss 2004



Pert. Australia 2009



Bolzano. Italy. 2011



JFK. USA 2012



Tomsk. Russia 2012



MAKS2013. Russia



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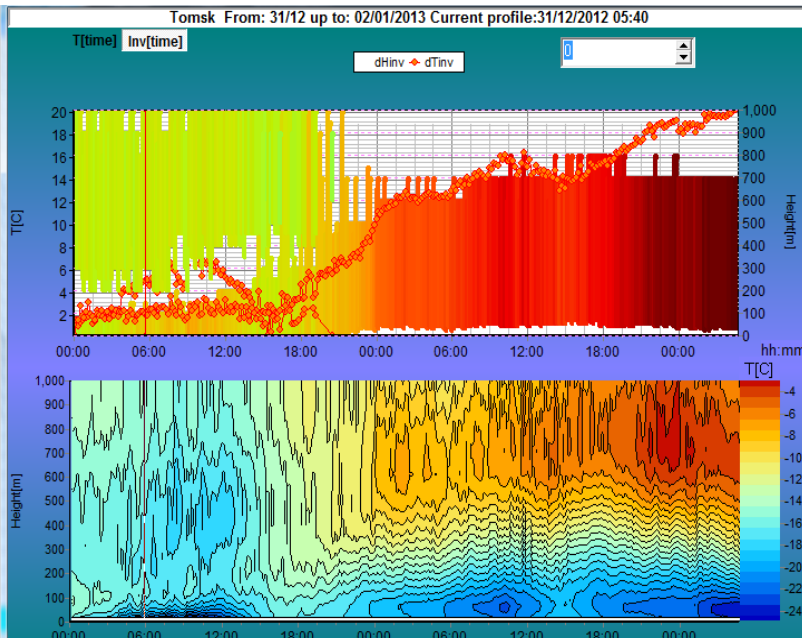
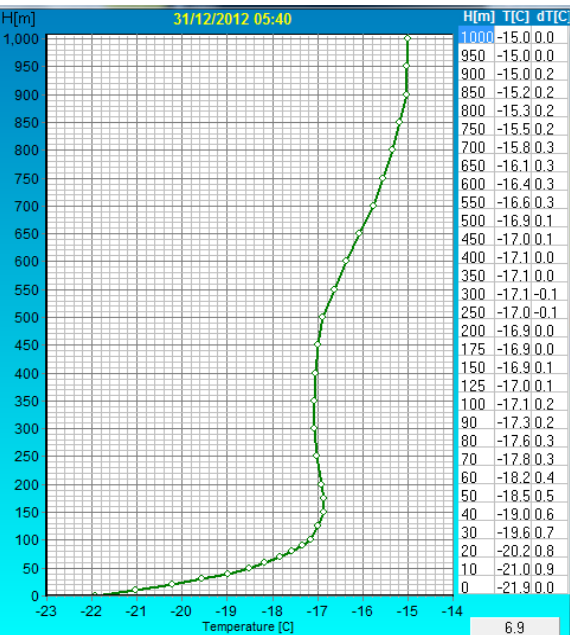
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WHY MTP-5? EXAMPLES OF THE DATA!



Geofysisk institutt - Været i Bergen. Webkamera

Siste døgn: Globalisering, Solaktivitet, Lufttemperatur, Nedbør, Vind, Luftfuktighet, Relativ luftfuktighet, Alle grafer

Temperaturprofil: 02.04.2013 16:45

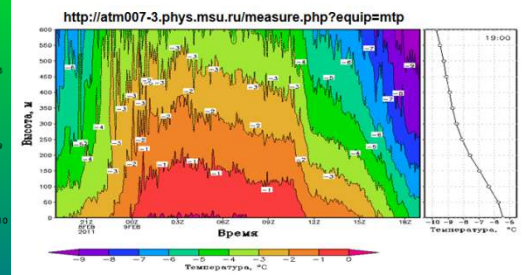
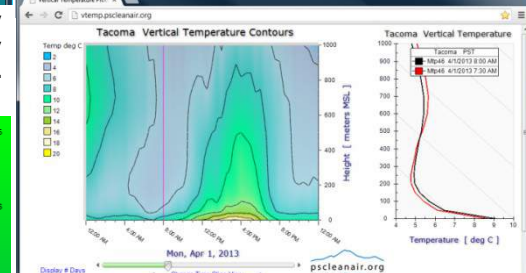
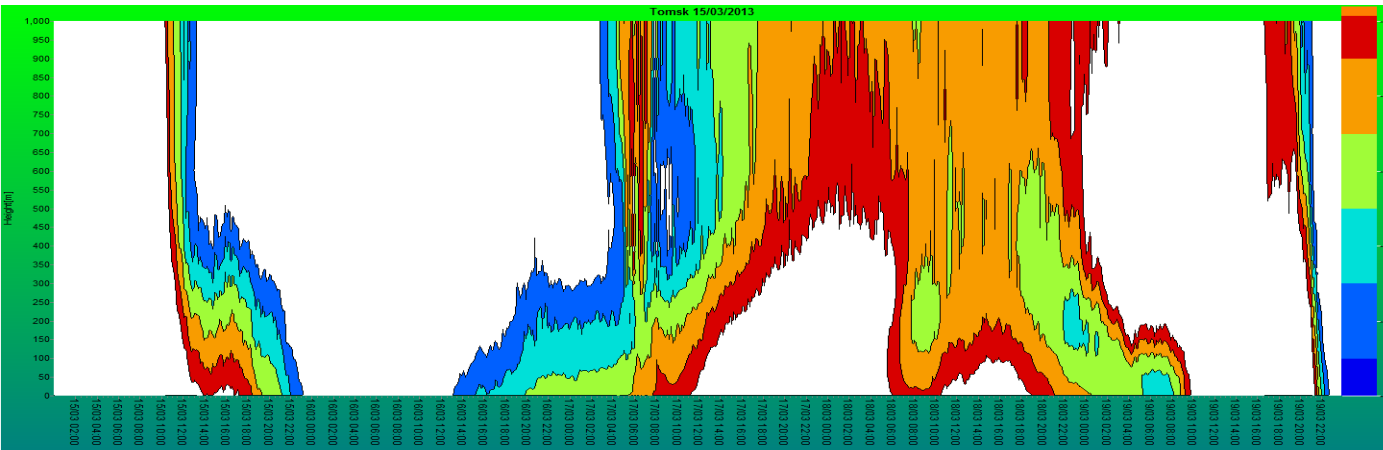
H(m)	T[C]	dT[C]
1000	-1.2	-0.3
950	-0.9	-0.3
900	-0.7	-0.4
850	-0.3	-0.3
800	0.0	-0.3
750	0.4	-0.3
700	0.7	-0.5
650	1.2	-0.5

heights hazardous for icing

...While the icing can occur over a wide range of negative temperatures, the probability is maximum in a relatively narrow range of temperatures and relative humidity (-5 ... -10°C and > 85% respectively).

http://method.hydromet.ru/publ/sb/sb37/sh_ice.pdf

Outside these intervals icing probability decreases rapidly.

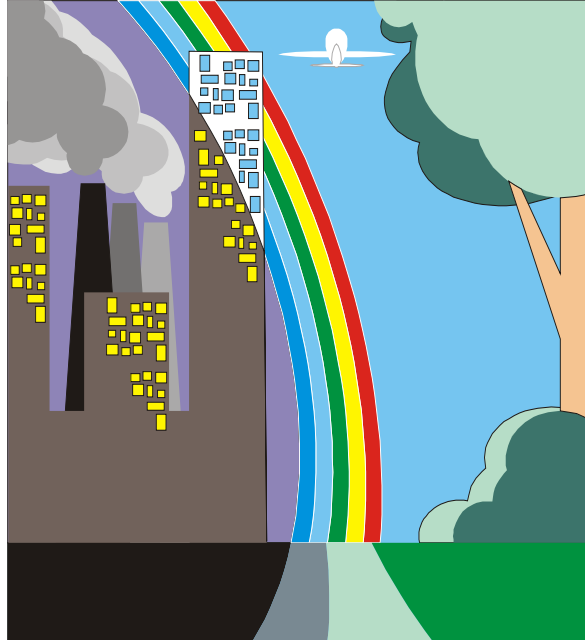




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WHY MTP-5? INTEGRATED MEASURING SYSTEMS!



•WIND SHEAR (MTP-5 + WIND PROFILE)

Control and monitoring of the temperature inversion periods potentially dangerous according MTP-5 data.

•TURBULENCE (MTP-5+solar radiation+wind gradient)

Measurement of turbulence and height of the mixing layer according MTP-5 data.

•FOG (MTP-5 +weather forecast+meteorological data)

The temperature profile determines the vertical transport of air masses and the condensation of the water vapor of the atmosphere. Control according to the MTP-5 provides a warning about the development and the scattering of fog.



MTP-5 Meteorological Temperature profile and LIDAR or SODAR



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WHY MTP-5? INTEGRATED MEASURING SYSTEMS!

wake vortex safety system

MTP-5 Meteorological Temperature profile and LIDAR

The screenshot displays the Windex 2000 client interface with several data panels:

- Top Panel:** Settings for wind speed (2, 10, 20 m/s), wind direction (0, 90, 180, 270, 360 degrees), and time (real-time, average, minimum, maximum). A green button labeled "ПРИМЕНИТЬ НАСТРОЙКИ" (Apply Settings) is visible.
- Left Panel:** "Параметры скорости ветра на высоте 250 м" (Wind speed parameters at 250 m):

Направление ветра	259.3 град
Скорость ветра горизонтальная	2.5 м/с
Встречно-попут. составляющая	1.9 м/с
Скорость ветра вертикальная	0.1 м/с
- Center Panel:** A circular wind profile visualization with a color gradient from blue (low speed) to red (high speed) and arrows indicating wind direction.
- Right Panel:** "Вертикальный профиль ветра" (Vertical wind profile) with two graphs: "по направлению" (by direction) and "по скорости" (by speed). The y-axis is "Высота, м" (0-300) and the x-axis is "Направление, град" (0-360) or "Скорость, м/с" (0-50).
- Bottom Panel:** "MTP-5" temperature profile graph showing "Температура (С)" (Temperature in Celsius) vs "Высота, м" (0-1000). A table of data points is shown:

Н(м)	T(С)	С(С)
1100	7.3	-0.5
950	7.8	-0.5
900	8.3	-0.4
850	8.7	-0.4
800	9.1	-0.4
750	9.6	-0.4
700	10.0	-0.5
650	10.5	-0.5
600	10.9	-0.5
550	11.4	-0.5
500	11.9	-0.4
450	12.3	-0.4
400	12.7	-0.3
350	13.0	0.0
300	13.1	0.0
250	13.1	0.1
200	13.0	0.3
150	12.7	0.5
100	12.2	0.6
50	11.6	0.7
0	10.9	0.0
- Bottom Right Panel:** "Meteorological Temperature Profiler (MTP-5) From: 07/05 up to: 08/05/2013 Current profile: 08/05/2013 04:50". It shows a multi-layered graph of temperature profiles over time (00:00 to 14:00) and a "Show adiabatic profile" checkbox.





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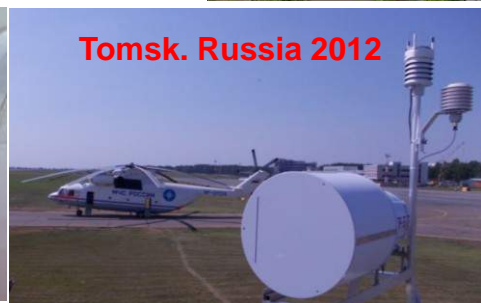
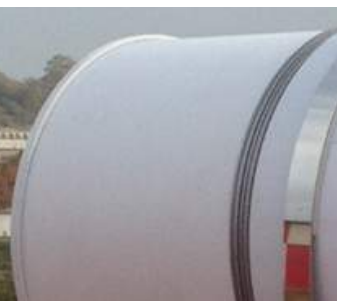
22 января 2015 г. на
экспериментальной авиабазе
Концерна «МАНС» «Орловка»
(Тверская область)



Толмачево 2015



СОЧИ 2014



Tomsk. Russia 2012



Kazan. Russia 2008



Zurich. Swiss 2004



Pert. Australia 2009



JFK. USA 2012



San Francisco. USA. 2014