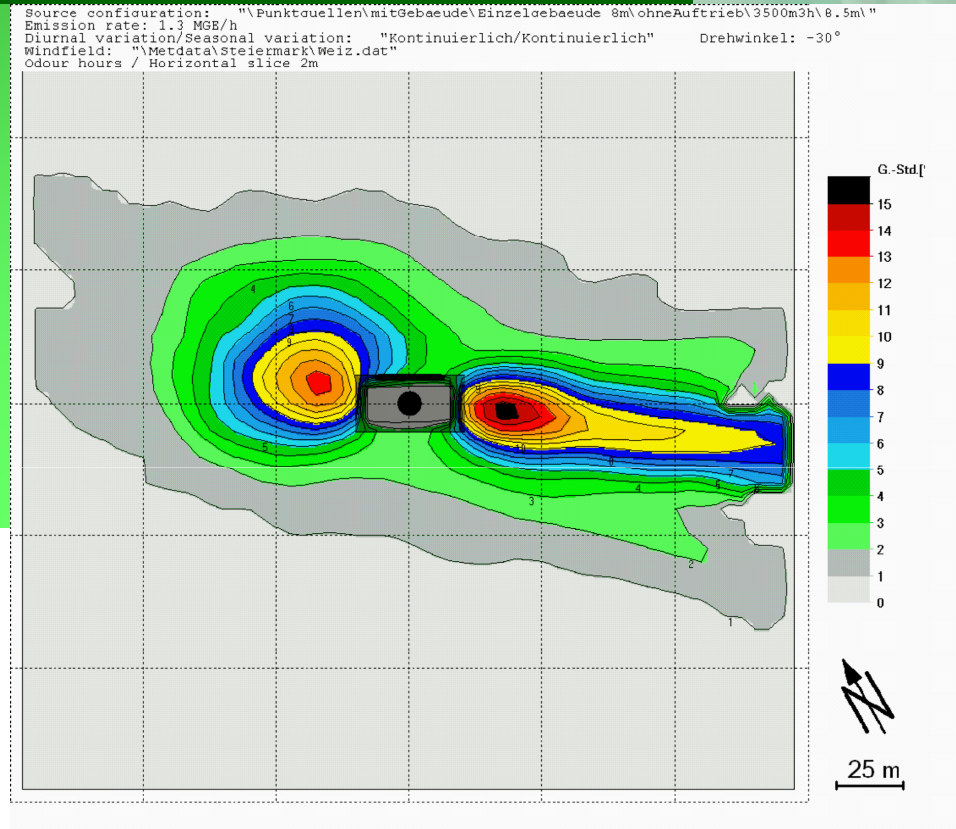# The Austrian guideline for short range dispersion modeling

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Air Quality Department of Styria

Source configuration: "\Punktquellen\mitGebaeude\Einzelgebaeude 8m\ohneAuftrieb\3500m3h\0.5m\"
Emission rate: 1.3 MGE/h
Diurnal variation/Seasonal variation: "Kontinuierlich/Kontinuierlich"   Drehwinkel: -30°
Windfield: "\Metdata\Steiermark\Weiz.dat"
Odour hours / Horizontal slice 2m

Motivations to develop a new tool

Requirements

- **Fast:** AQ assessment during licensing procedure (within 1-2 hours)

- **No speed limit:** Applicable for the whole range of wind speeds

- **Versatile:** Many different kinds of sources (parking lots, stacks with/without building downwash, etc.)

- **One-stop-shop:** It is desireable to have only one tool (model) for all kinds of sources

- **Easy to use:** Administration is not science!

- **Robustness:** Different users should obtain comparable results (remember: SEC-study, Podbie-study)

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# Basic concept of ADAS (Austrian Database for Air Quality Assessment near small Sources)

Pre-defined source configurations

- 7 different point sources (136 variations)
- 18 different area sources
- 3 different line sources
- 6 different basement garages

505 pre-defined dispersion conditions

- 5 stability classes (AB, C, DE, F, G)
- Wind speed classes: 0.3, 0.75, 1.5, 2.5, 3.5, 4.5, 6.0, 8.0 m/s
- Wind direction: 20 deg. steps

AQM
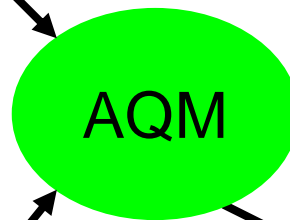
Meteorological data

Time series of (half-) hourly classified wind speed, -direction, stability class

Emission

- Daily variation
- Monthly variation
- Source strength

2D concentration data for 505 situations

- Annual mean
- Maximum daily mean
- Max. hourly mean
- Odour hours

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Selection of an air quality model

Potential candidate models:

AUSTAL2000/LASAT

MISKAM: Only applicable in built-up areas, neutral atmospheric
stability, non-buoyant releases

ADMS

GRAL

Problems:

Field experiments for short range dispersion are rare

Wind tunnel experiments cover only neutral atmospheric stability

⟶ very limited evaluation phase

Das Land
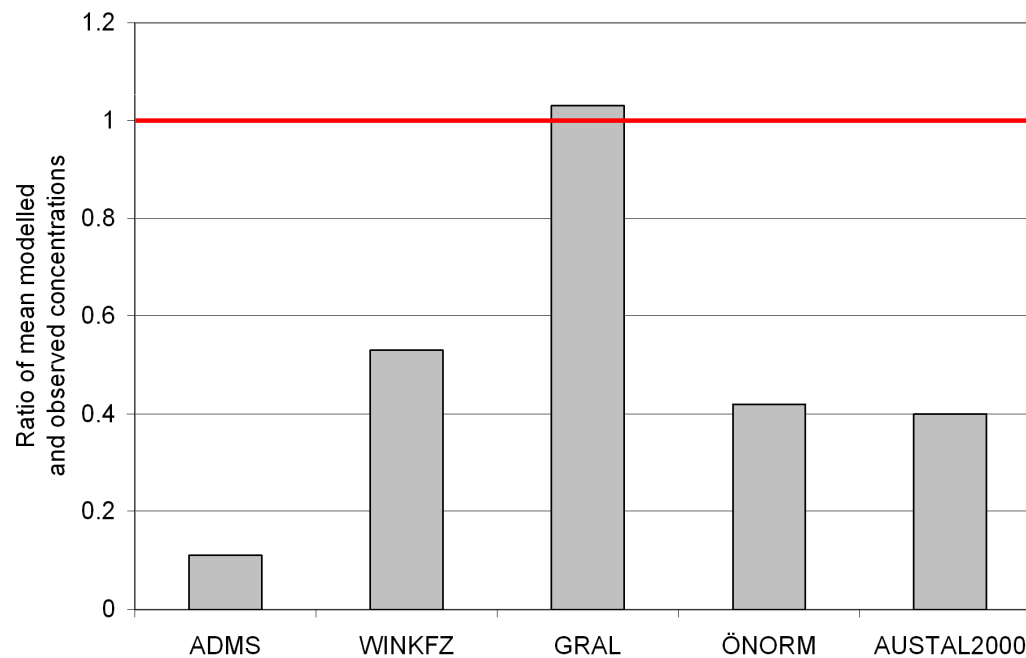Steiermark

Selection of an air quality model

Tracer experiment "Raaba" (Anfossi et al., 2006)

Low-wind speed conditions

Point source near surface

Tracer sampling: 50 m distance from the source

→ Luftgüteüberwachung
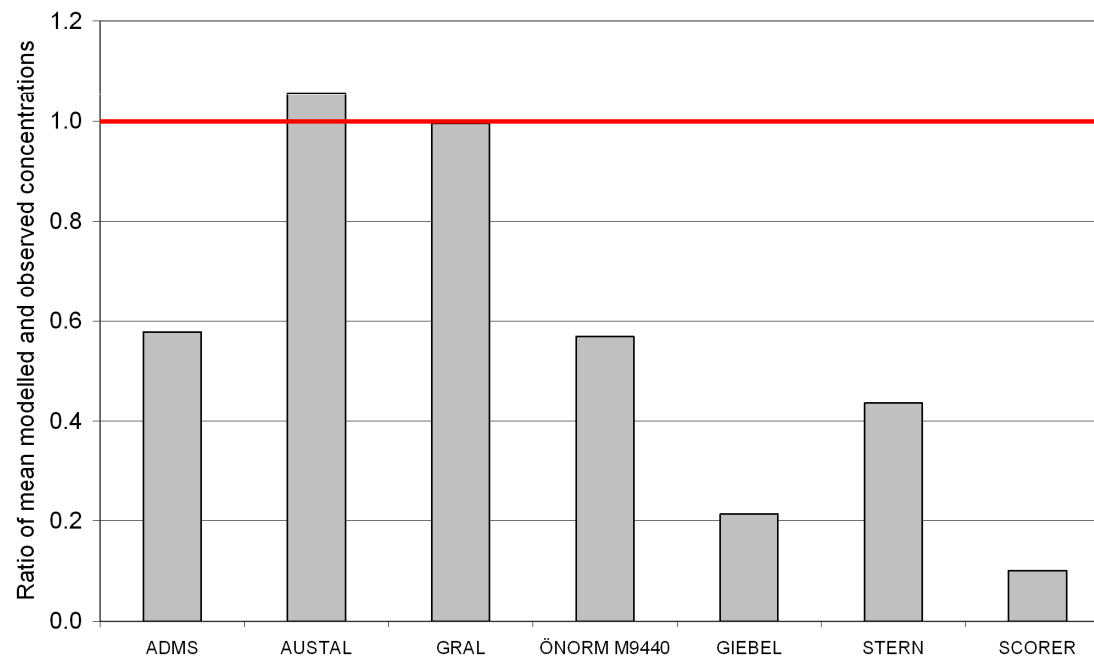
Selection of an air quality model

Tracer experiment "Uttenweiler" (Bächlin et al., 2002)

Moderate – high wind speeds

Point source (pig stable) with building downwash

Tracer sampling: ~150 m distance from the source

→ Luftgüteüberwachung

GRAL 4.10 quick overview

- Lagrangian particle model designed for all wind speeds
- Validated using 27 field and wind tunnel experiments
- Model documented by Oettl and Uhrner (2010)
- Major improvements since GRAL 6.8 regarding small sources
  - Time step is set constant ($\Delta t = 0.2$ s) in plume rise equations (Hurly, 2005)
  - Influence of buildings: flow and turbulence fields from the prognostic wind field model GRAMM (k-ε closure)

$$\sigma_u = \sigma_v = \sigma_w = \sqrt{\frac{k}{1.5}}$$

as long as:

$$\varepsilon_{GRAMM} < \quad \varepsilon = \frac{u_*^3}{z}\left[1 + 1.5 \cdot \left|\frac{z}{L}\right|^{0.6}\right]^{1.8}$$

→ Luftgüteüberwachung

ADAS Evaluation

Experiment	Source	Buildings	Obs.	ADAS	FB (±0.3)
Uttenweiler	Point	Yes	8.5	8.4	0.01
Roager	Point	Yes	71	73	-0.02
Caltrans99	Line	No	69	77	-0.11
A2 Biedermannsdorf	Line	No	61	78	-0.24
Göttinger Straße	Line	Yes	257	230	0.11
Frankfurter Allee	Line	Yes	67	120	**-0.57**
Hornsgatan	Line	Yes	148	160	-0.08
Parking lot Vienna	Area	Yes	1484	1144	0.26

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→ Luftgüteüberwachung

ADAS free download site

http://www.umwelt.steiermark.at/cms/beitrag/11257761/2222407/

- Download site is still in German
- ADAS is bi-lingual (German and English)
- User-guide is included in the package (German and English)
- Runs on Windows PCs
- If you want to receive update information in the future send me your email address: dietmar.oettl@stmk.gv.at

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FIN

Thanks!

→ Luftgüteüberwachung

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ADAS graphical user interface (GUI)

Fixed model domain:

300 x 300 m²

5 x 5 m² resolution

→ Luftgüteüberwachung

ADAS graphical user interface (GUI)

ADAS graphical user interface (GUI)

Diurnal variation / Daytime

Seasonal variation / Non-exhaust emissions traffic
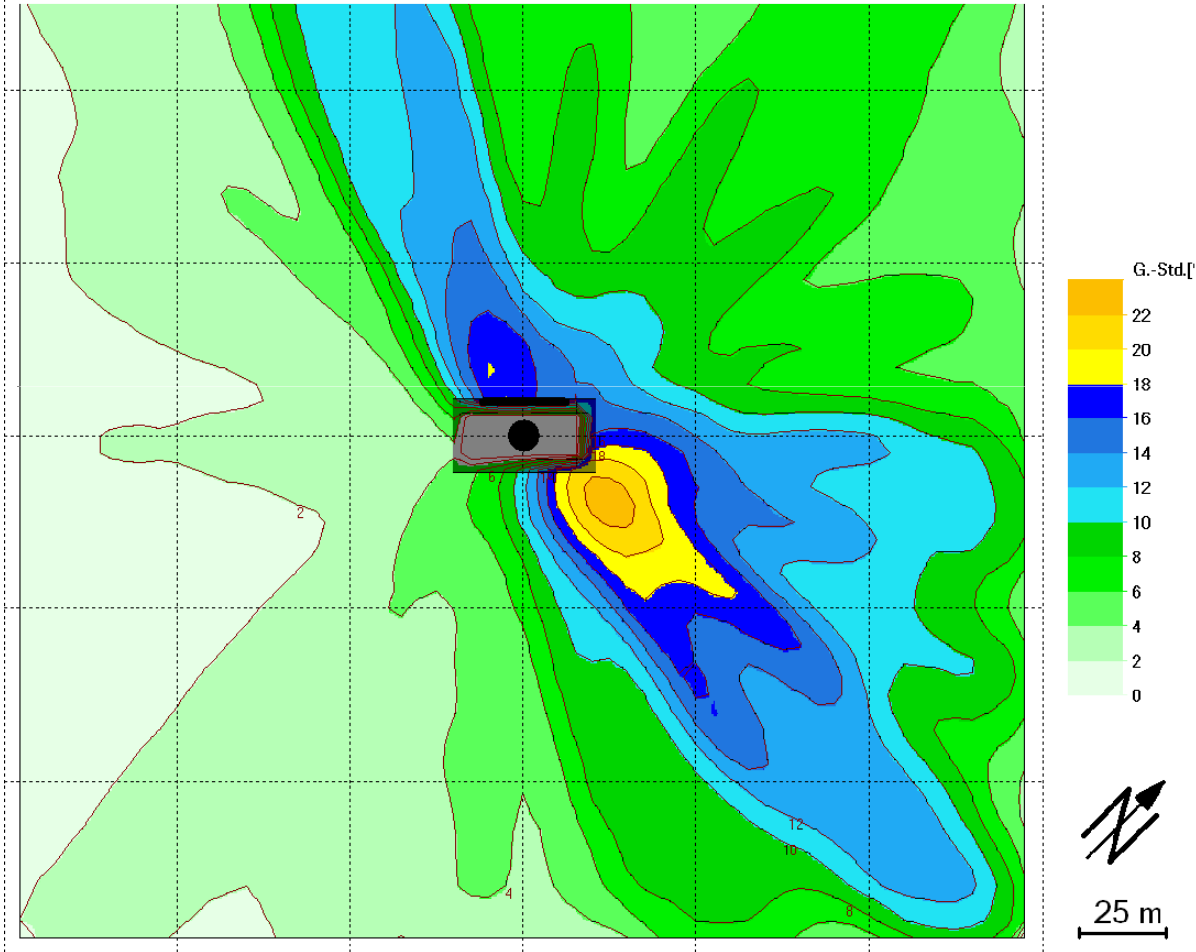
→ Luftgüteüberwachung
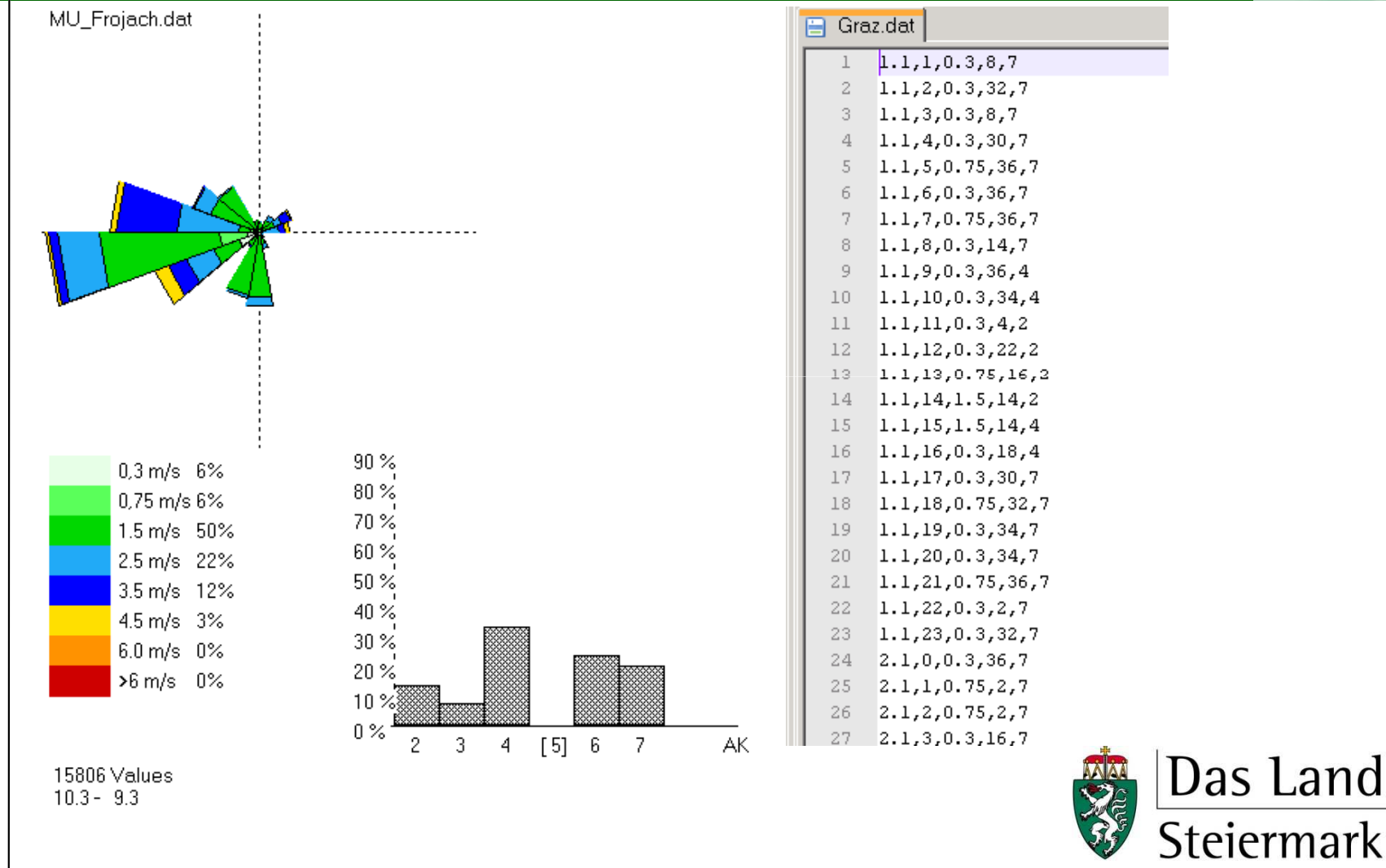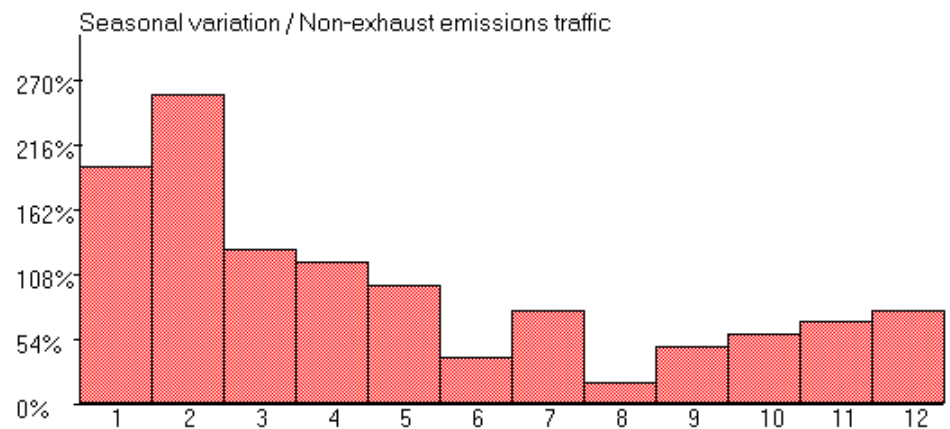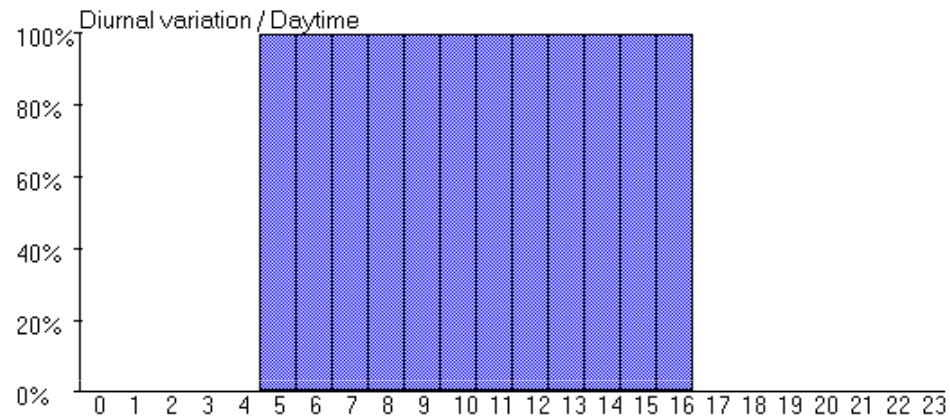
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ADAS graphical user interface (GUI)

Source configuration: "\Point Sources\with buildings\8m high building\without buovancv\3500m3h\8.5m'
Emission rate: 5.4 MOU/h
Diurnal variation/Seasonal variation: "Constant/Constant"   Angle: 45°
Meteorologv: "\Metdata\International\Hannover.dat"
Odour hours / Horizontal slice 2m