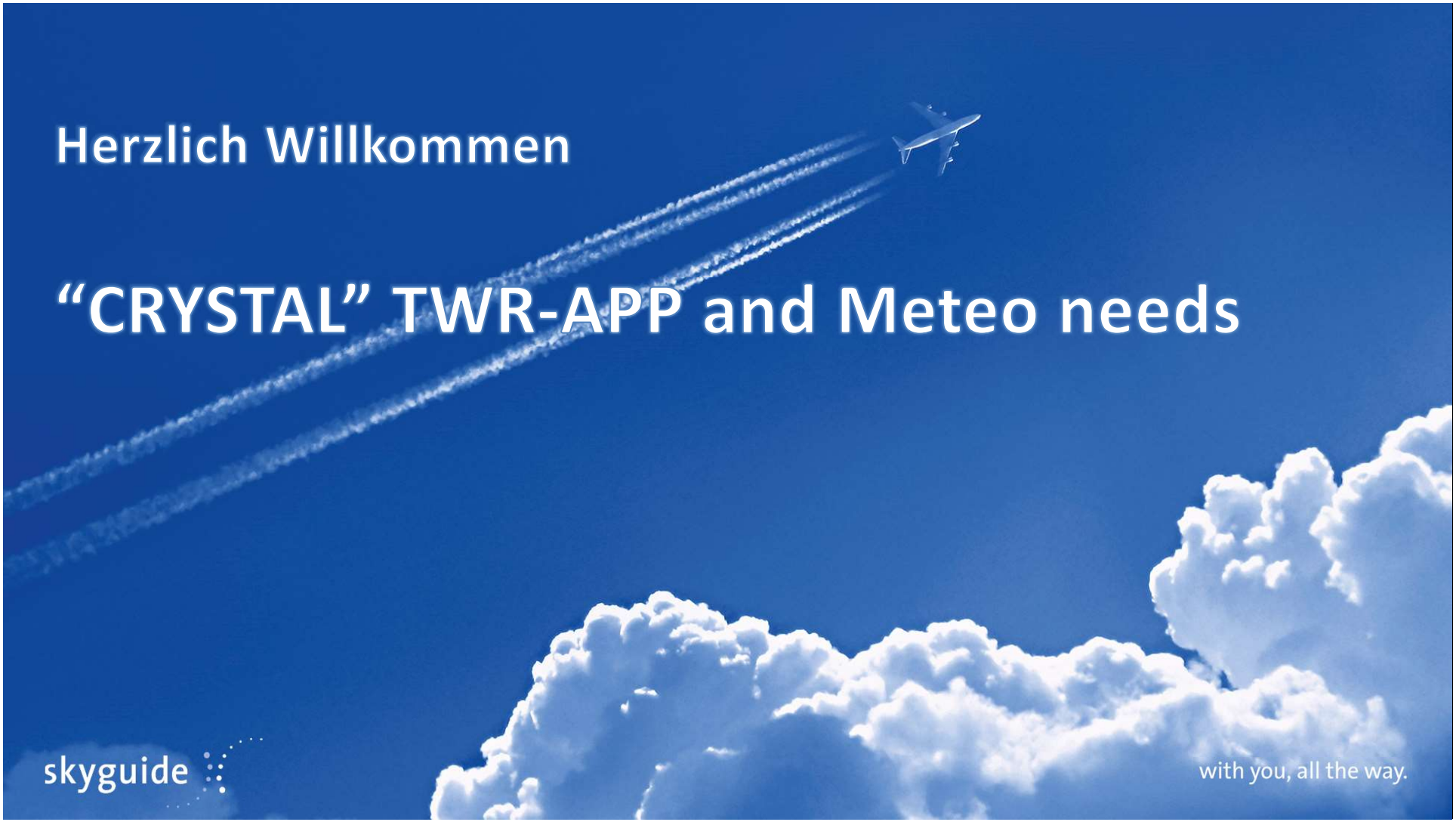
Herzlich Willkommen

“CRYSTAL” TWR-APP and Meteo needs



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with you, all the way.

AGENDA

- **ATFCM (Air Traffic Control Management)**
- What is CRYSTAL
- Why do we need CRYSTAL
- How does WX influence CRYSTAL
- CRYSTAL needs in terms of WX data

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Air Traffic Flow and Capacity Management

It is an ongoing process to provide the users with the highest available capacity in the most efficient way and avoiding overloads within the European ATM network.

First priority: SAFETY

The main task given to skyguide by the swiss confederation says; provide a SAFE, ORDERLY and EFFICIENT flow of traffic.
This may require regulations and delaying traffic, but prior doing that all possible optimizations have to be analyzed and implemented. CRYSTAL is an next step to improve the situation for Zürich and Geneva. The area control center relies for quite some time on a similar prediction tool.

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What is CRYSTAL

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CRYSTAL predicts the upcoming air traffic situation for Zürich and Geneva TWR/APP units, considering:

- **Traffic (numbers, types of aircraft, approach path according landing concept, crossing traffic, leaving and joining traffic)**
  - **→ For each sector, Approach East/ West and Departure**

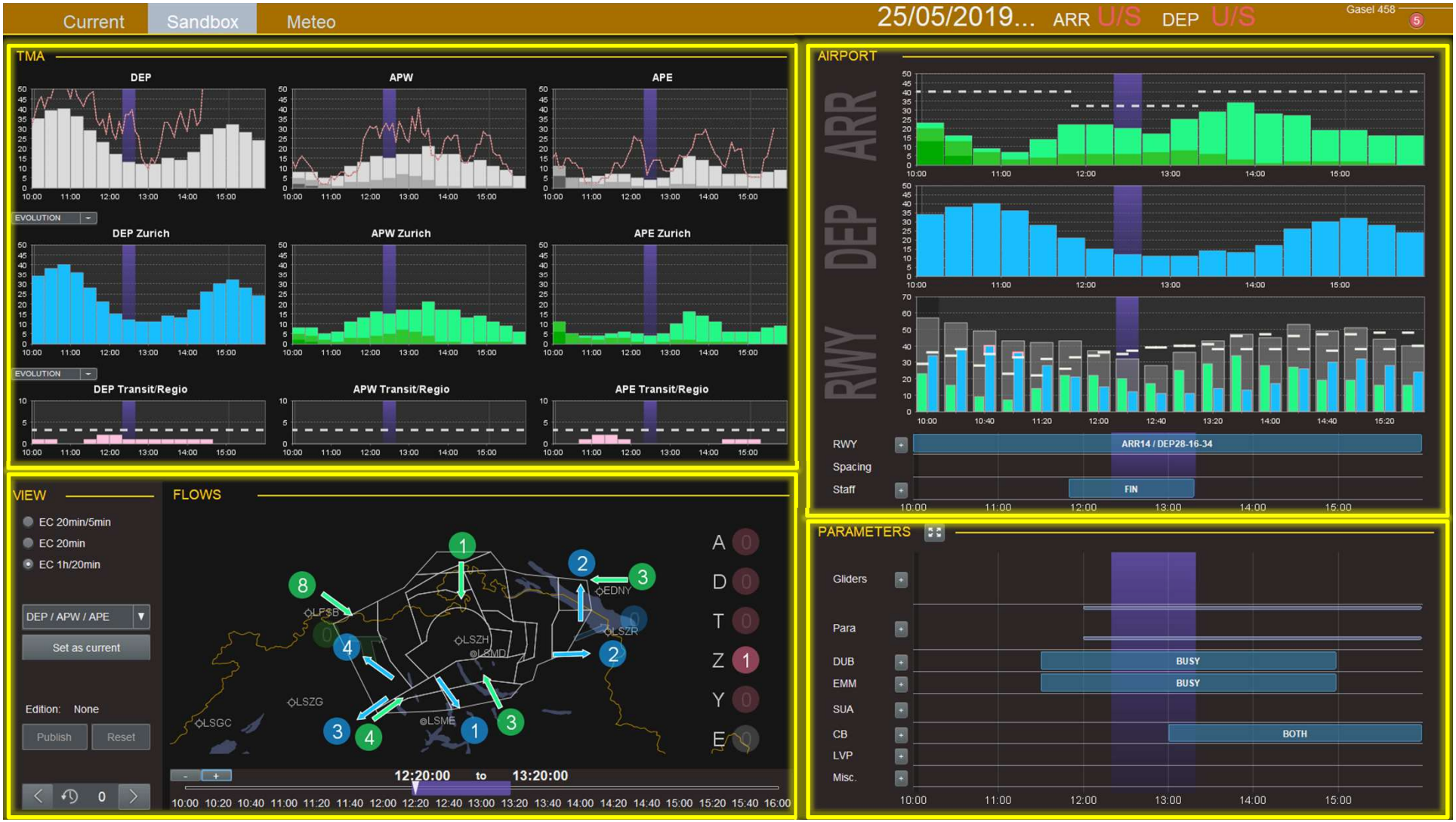
External factors:

- **-Staff**
- **-Airspace elements (e.g.: military activity, gliders, SUAs…)**
- **-Maintenance activities**
- **-WX data**

With this information, the TWR supervisor:

- **-Can better organise the upcoming traffic management**
- **-Reduce delays**
- **-Improve safety**


Current
Sandbox
Meteo
25/05/2019...
ARR U/S
DEP U/S
Gasel 458
5
TMA
DEP
APW
APE
EVOLUTION
DEP Zurich
APW Zurich
APE Zurich
DEP Transit/Regio
APW Transit/Regio
APE Transit/Regio
AIRPORT
ARR
DEP
RWY
RWY
10:40 - 11:40
48 flights
6 ARR
42 DEP (8)
32 ARR MRT
34 DEP MRT
RWY
Spacing
Staff
ARR14 / DE
FIN
VIEW
EC 20min/5min
EC 20min
EC 1h/20min
FLOWS
LFSB
LSZH
LSMD
EDNY
LSZR
LSZG
LSGC
LSME
A 1
D 0
T 0
Z 0
Y 0
E 0
08:40:00 to 09:40:00
PARAMETERS
Gliders
Para
DUB
EMM
SUA
CB
LVP
Misc.


Current
Sandbox
Meteo
25/05/2019...
ARR U/S
DEP U/S
Gasel 458
TMA
DEP
APW
APE
EVOLUTION
DEP Zurich
APW Zurich
APE Zurich
DEP Transit/Regio
APW Transit/Regio
APE Transit/Regio
AIRPORT
ARR
DEP
RWY
RWY
Spacing
Staff
ARR14 / DEP28-16-34
FIN
VIEW
EC 20min/5min
EC 20min
EC 1h/20min
DEP / APW / APE
Set as current
Edition: None
Publish
Reset
FLOWS
LFSB
LSZH
LSMD
LSZG
LSGC
LSME
EDNY
LSZR
A
D
T
Z
Y
E
12:20:00 to 13:20:00
PARAMETERS
Gliders
Para
DUB
EMM
SUA
CB
LVP
Misc.
BUSY
BUSY
BOTH

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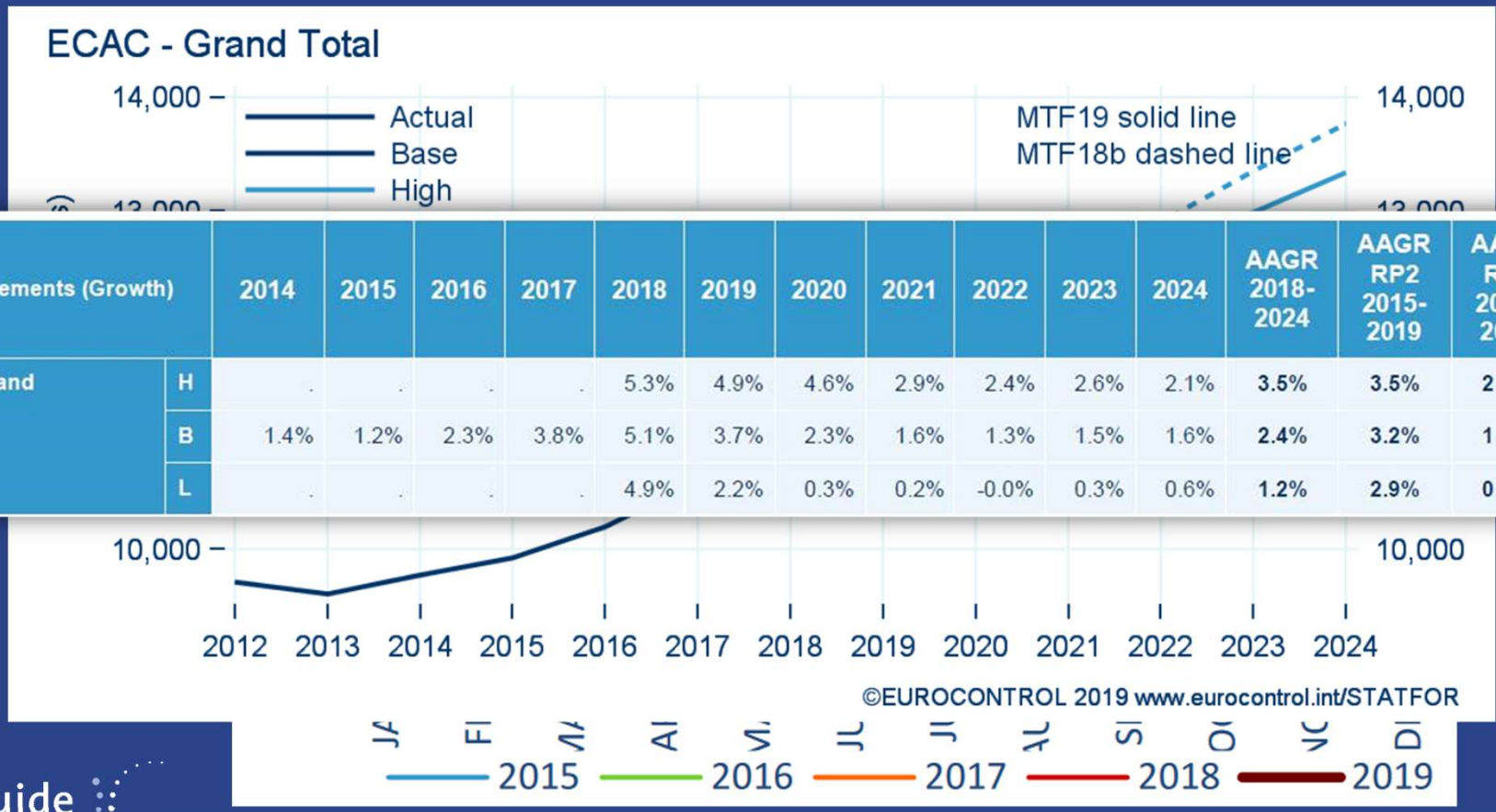
Why do we need CRYSTAL



IFR Movements (Growth)		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	AAGR 2018-2024	AAGR RP2 2015-2019	AAGR RP3 2020-2024
Switzerland	H	.	.	.	.	5.3%	4.9%	4.6%	2.9%	2.4%	2.6%	2.1%	**3.5%**	**3.5%**	**2.9%**
	B	1.4%	1.2%	2.3%	3.8%	5.1%	3.7%	2.3%	1.6%	1.3%	1.5%	1.6%	**2.4%**	**3.2%**	**1.7%**
	L	.	.	.	.	4.9%	2.2%	0.3%	0.2%	-0.0%	0.3%	0.6%	**1.2%**	**2.9%**	**0.3%**

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How does WX influence ATC operations

Weather is responsible for:

ca. 30% (CB/TS, and Wind for CH) ATM delays in Europe

25.5% ATFM delays

80% increase in delay minutes

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How does WX influence CRYSTAL

The better the predictions, the more efficient we can be.

Each time a new WX report arrives:

- SPVR will reassess the situation (CBs, wind, fog…)
- Forecast still correct?! Measurements correct?!
- What is/are the impacts on the airspace.

WX impacts:

- -Traffic complexity in the APP (storms, winds)
- -Minimum distance between 2 aircraft on final approach (visibility, runway condition, wind)
- -Handling stop

As a consequence, TWR SPVR:

- -Could implement measures ➔ DELAY
- -Stop/limit activities (SUA, gliders, para) within the airspace

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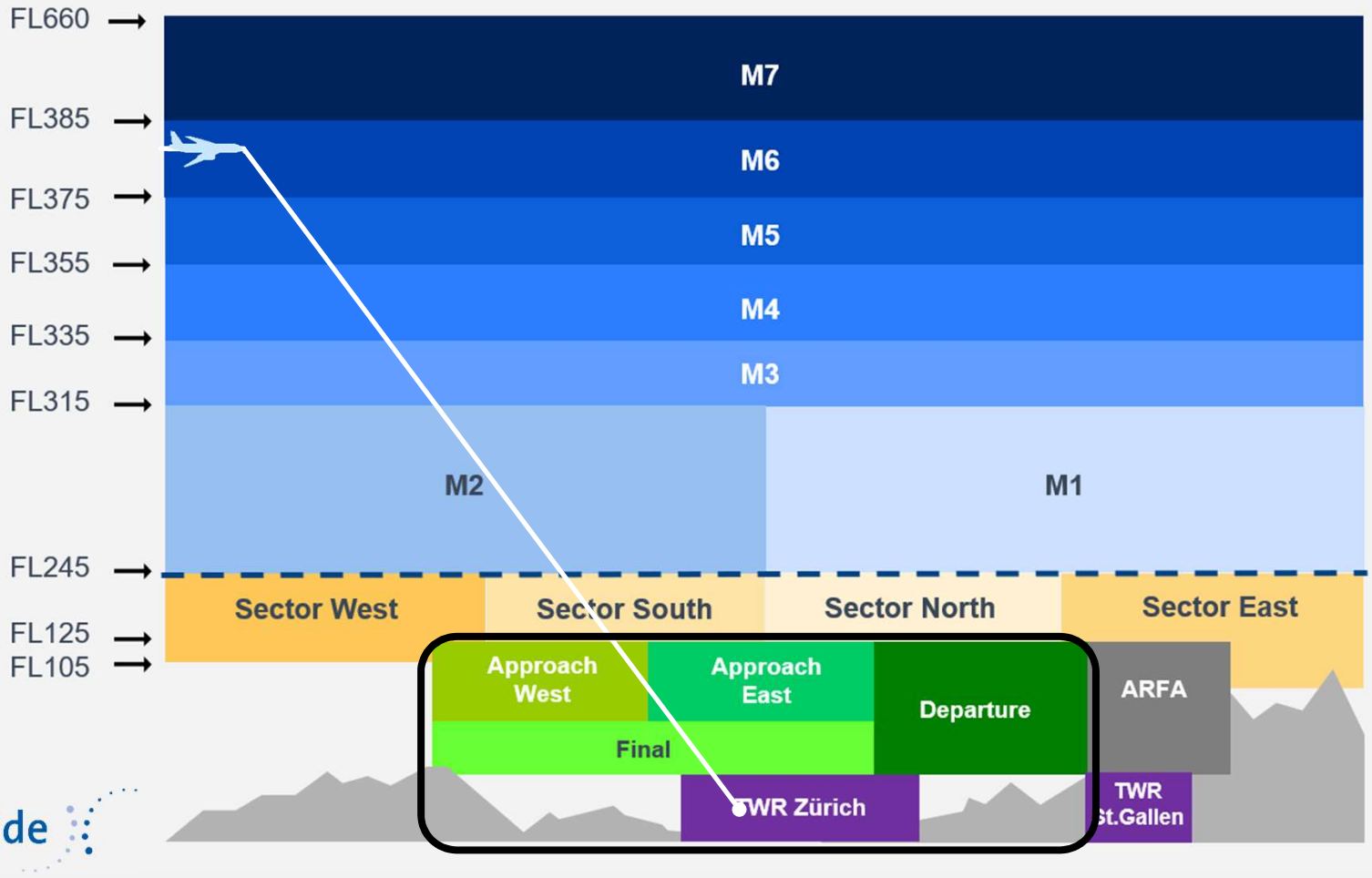
Luftraum-Sektorisierung in Zürich



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Anflug-Konzepte Zürich

DVO=Deutsche Verordnung

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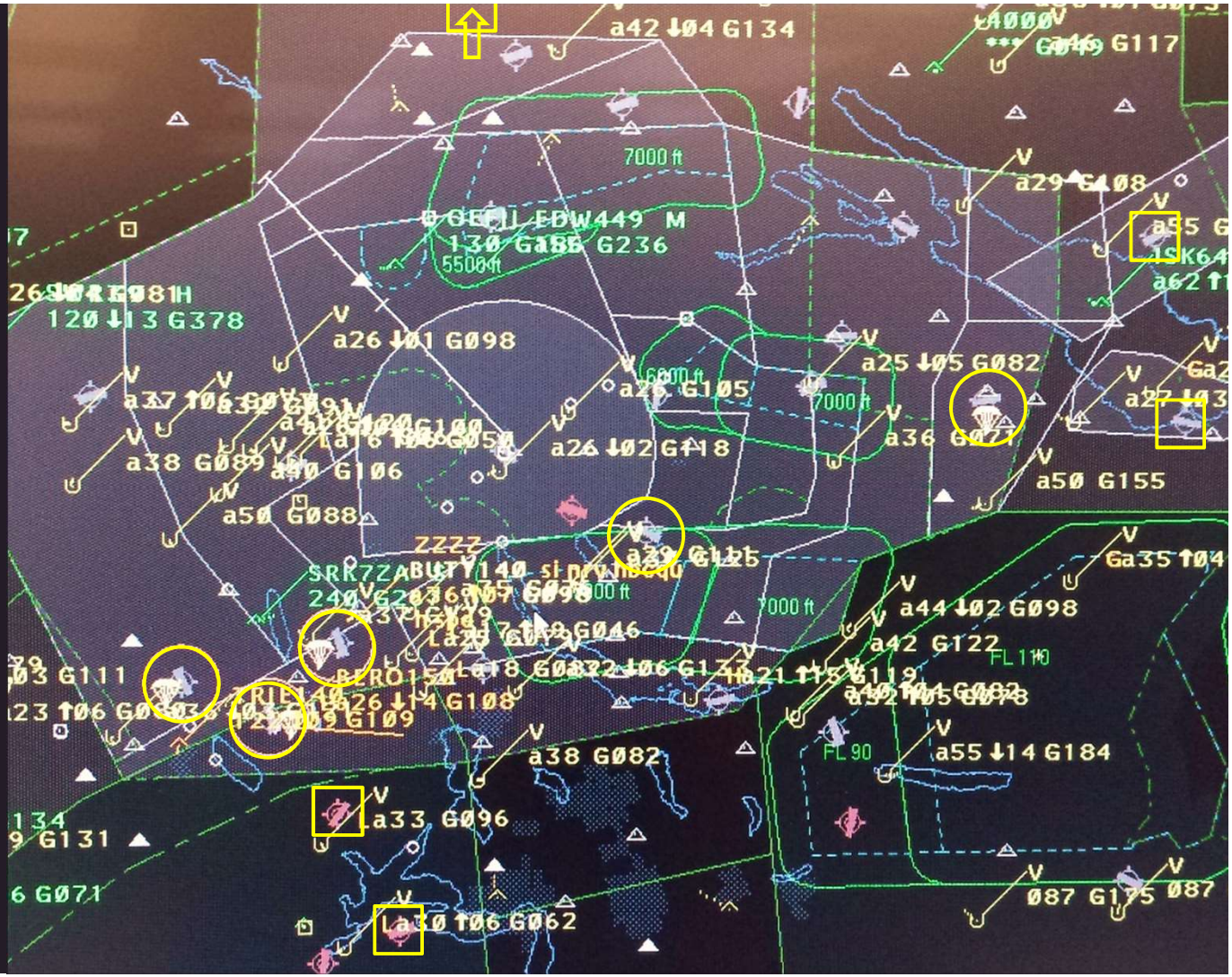
Der Luftraum

Fallschirmsprung-Zonen
- *-Triengen*
- *-Beromünster*
- *-Buttwil*
- *-Speck-Fehraltdorf*
- *-Sitterdorf*

Flugplätze mit Y/Z-Flügen
- *-Buochs (Pilatus)*
- *-Emmen*
- *-St.Gallen*
- *-Friedrichshafen*
- *-Donaueschingen*



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The necessary data (but not all used in CRYSTAL)

- temp/dew point
- fog
- QNH
- ground wind
- wind at 1000ft
- wind at 5000ft
- precipitation (mm)
- snow altitude (airport) (only in GVA)
- ground wind gusts
- ceiling (altitude)
- Octans at 200ft
- Octans at 900ft (only in ZRH)
- Octans at 1500ft
- Octans at 4600ft (only in GVA)

- visibility
- vis probability <5km
- vis probability <800m (only in GVA)
- vis probability <400m
- airport CB probability
- airport TS probability
- TMA CB probability (planned to be split into three areas, West, East and South)
- TMA TS probability
- WX airport alerts
- surface condition (probability of surface contamination)
- FL100 and FL180 corrections (only in GVA), and FL140 (only in ZRH)

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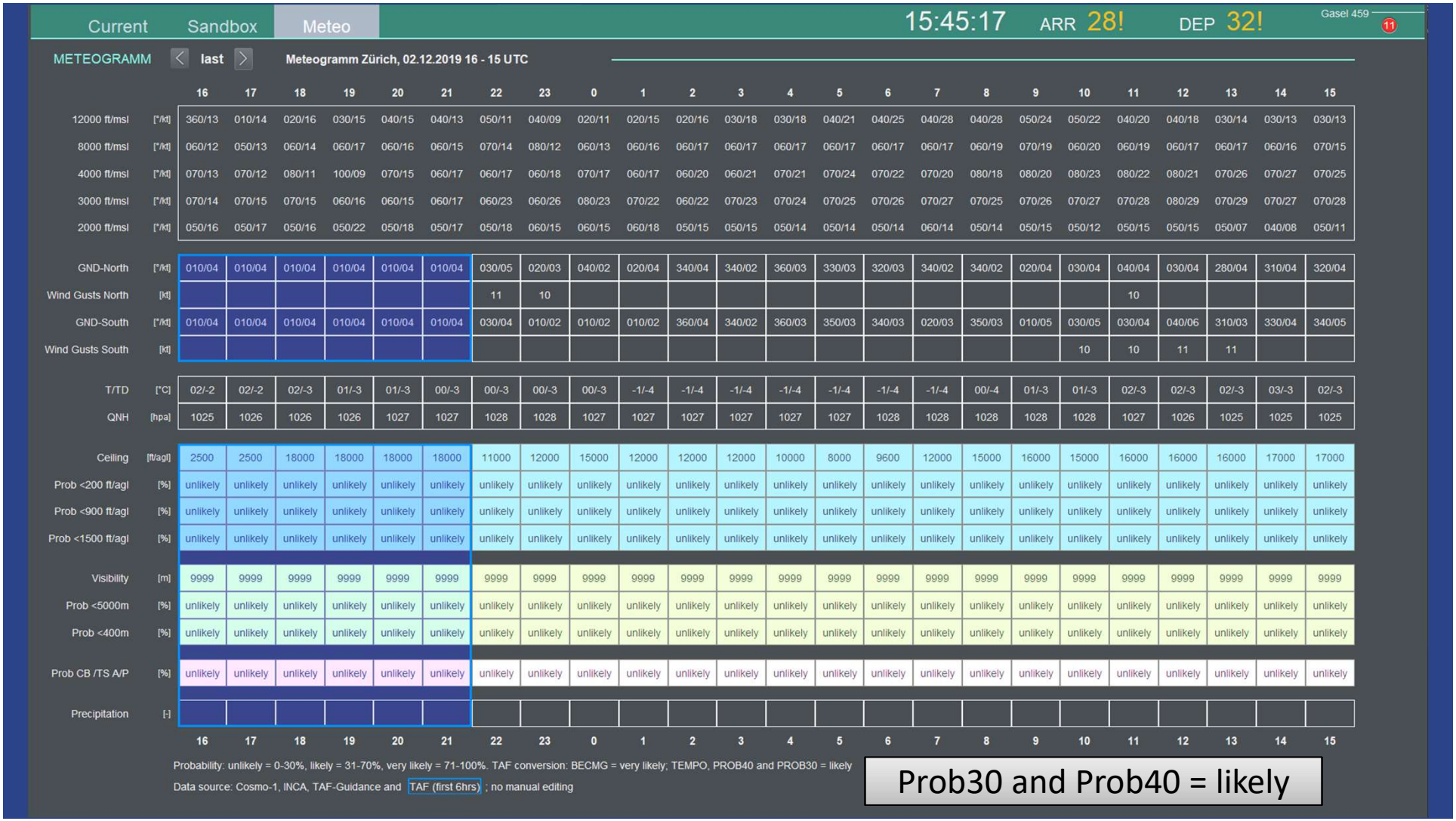
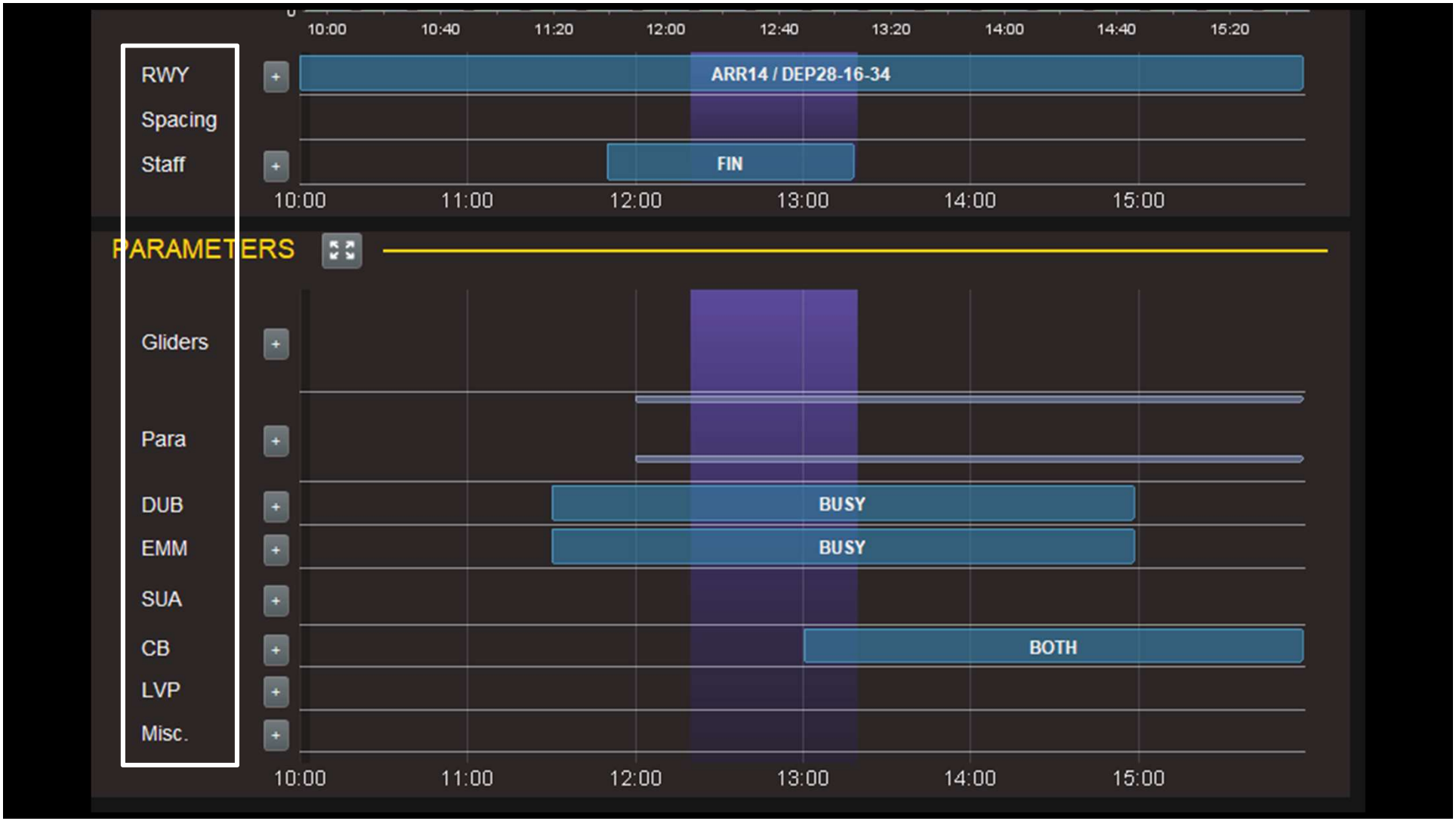

Current
Sandbox
Meteo
15:45:17
ARR 28!
DEP 32!
Gasel 459
11
METEOGRAMM
last
Meteogramm Zürich, 02.12.2019 16 - 15 UTC
16 17 18 19 20 21 22 23 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
12000 ft/msl [°/kt] 360/13 010/14 020/16 030/15 040/15 040/13 050/11 040/09 020/11 020/15 020/16 030/18 030/18 040/21 040/25 040/28 040/28 050/24 050/22 040/20 040/18 030/14 030/13 030/13
8000 ft/msl [°/kt] 060/12 050/13 060/14 060/17 060/16 060/15 070/14 080/12 060/13 060/16 060/17 060/17 060/17 060/17 060/17 060/17 060/19 070/19 060/20 060/19 060/17 060/17 060/16 070/15
4000 ft/msl [°/kt] 070/13 070/12 080/11 100/09 070/15 060/17 060/17 060/18 070/17 060/17 060/20 060/21 070/21 070/24 070/22 070/20 080/18 080/20 080/23 080/22 080/21 070/26 070/27 070/25
3000 ft/msl [°/kt] 070/14 070/15 070/15 060/16 060/15 060/17 060/23 060/26 080/23 070/22 060/22 070/23 070/24 070/25 070/26 070/27 070/25 070/26 070/27 070/28 080/29 070/29 070/27 070/28
2000 ft/msl [°/kt] 050/16 050/17 050/16 050/22 050/18 050/17 050/18 060/15 060/15 060/18 050/15 050/15 050/14 050/14 050/14 060/14 050/14 050/15 050/12 050/15 050/15 050/07 040/08 050/11
GND-North [°/kt] 010/04 010/04 010/04 010/04 010/04 010/04 030/05 020/03 040/02 020/04 340/04 340/02 360/03 330/03 320/03 340/02 340/02 020/04 030/04 040/04 030/04 280/04 310/04 320/04
Wind Gusts North [kt] 11 10 10
GND-South [°/kt] 010/04 010/04 010/04 010/04 010/04 010/04 030/04 010/02 010/02 010/02 360/04 340/02 360/03 350/03 340/03 020/03 350/03 010/05 030/05 030/04 040/06 310/03 330/04 340/05
Wind Gusts South [kt] 10 10 11 11
T/TD [°C] 02/-2 02/-2 02/-3 01/-3 01/-3 00/-3 00/-3 00/-3 00/-3 -1/-4 -1/-4 -1/-4 -1/-4 -1/-4 -1/-4 -1/-4 00/-4 01/-3 01/-3 02/-3 02/-3 02/-3 03/-3 02/-3
QNH [hpa] 1025 1026 1026 1026 1027 1027 1028 1028 1027 1027 1027 1027 1027 1027 1028 1028 1028 1028 1028 1027 1026 1025 1025 1025
Ceiling [ft/agl] 2500 2500 18000 18000 18000 18000 11000 12000 15000 12000 12000 12000 10000 8000 9600 12000 15000 16000 15000 16000 16000 16000 17000 17000
Prob <200 ft/agl [%] unlikely
Prob <900 ft/agl [%] unlikely
Prob <1500 ft/agl [%] unlikely
Visibility [m] 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999
Prob <5000m [%] unlikely
Prob <400m [%] unlikely
Prob CB /TS A/P [%] unlikely
Precipitation [-]
16 17 18 19 20 21 22 23 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Probability: unlikely = 0-30%, likely = 31-70%, very likely = 71-100%. TAF conversion: BECMG = very likely; TEMPO, PROB40 and PROB30 = likely
Data source: Cosmo-1, INCA, TAF-Guidance and TAF (first 6hrs) ; no manual editing
Prob30 and Prob40 = likely


10:00
10:40
11:20
12:00
12:40
13:20
14:00
14:40
15:20
RWY
Spacing
Staff
ARR14 / DEP28-16-34
FIN
10:00
11:00
12:00
13:00
14:00
15:00
PARAMETERS
Gliders
Para
DUB
EMM
SUA
CB
LVP
Misc.
BUSY
BUSY
BOTH
10:00
11:00
12:00
13:00
14:00
15:00

METEOGRAMM “TAF kongruent” und die Zukunft

Skyguide and METEO CH werden das METEOGRAMM auch weiterhin verbessern und ergänzen um eine hochqualitative Grundlage zu schaffen.

Die neuen METEO CH Produkte sollen, wenn für CRYSTAL nutzbar, eingebunden werden können.

Es bestehen zum Beispiel Bestrebungen die CB und TS Prognose von einer reinen Warnung für den Flugplatz/CTR auf die drei Regionen West, Ost und Süd(Alpen) auszuweiten. Diese geografische Aufteilung entspricht auch der Aufteilung des Luftraums für Zürich An- und Abflug und soll eine präzisere Komplexitätsberechnung sowie eine realistischere Kapazität erlauben.

CRYSTAL profitiert automatisch von allen relevanten Verbesserung (Modell, Genauigkeit, Auflösung etc.) da die Daten von METEO CH in bestmöglicher Qualität gestreamt werden.

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Fragen?

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