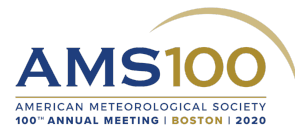




Meteodrones



Dr. Martin Fengler

CEO

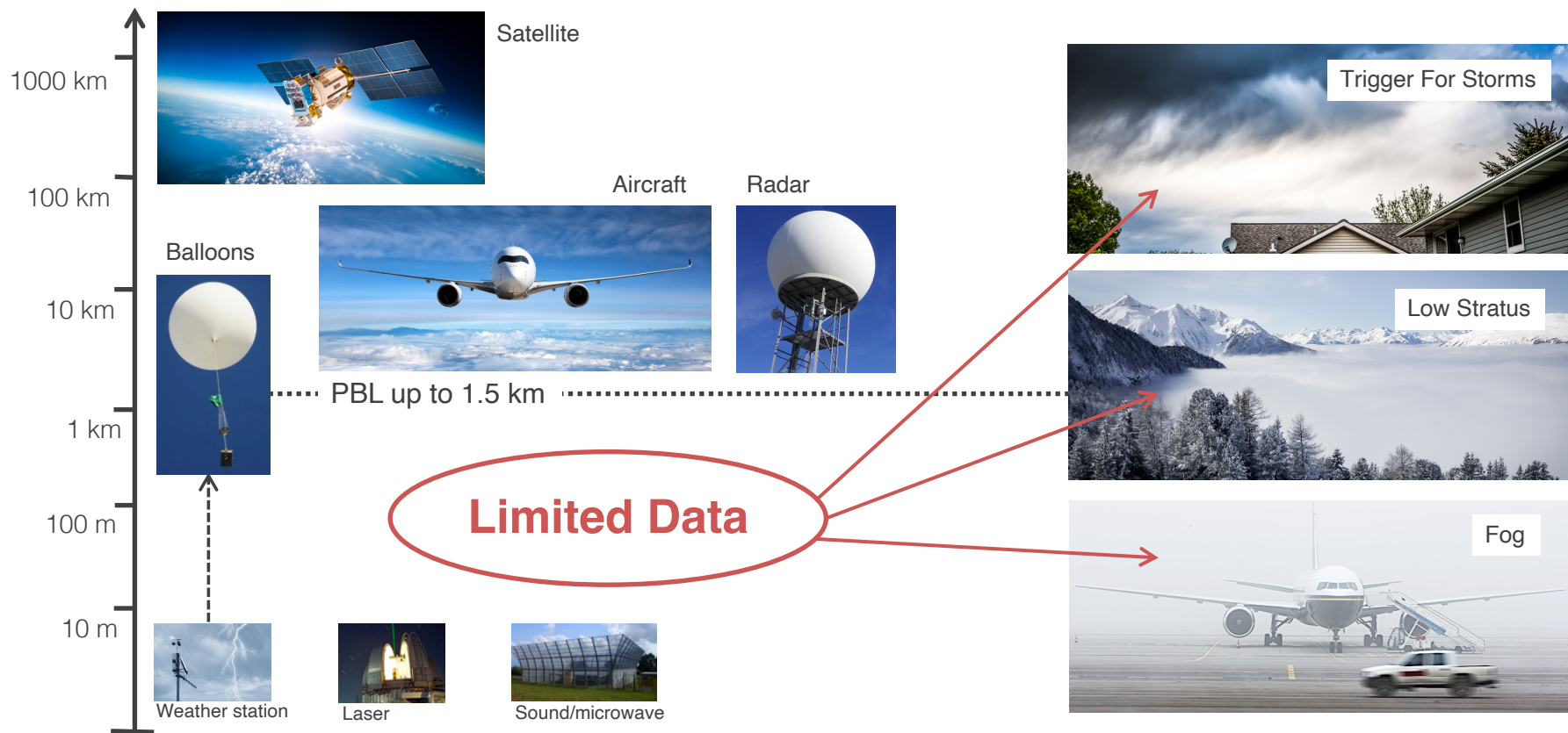
World class talent in meteorology, data science, drone development and service delivery

30 people | 3 offices | 3 countries | global partnerships

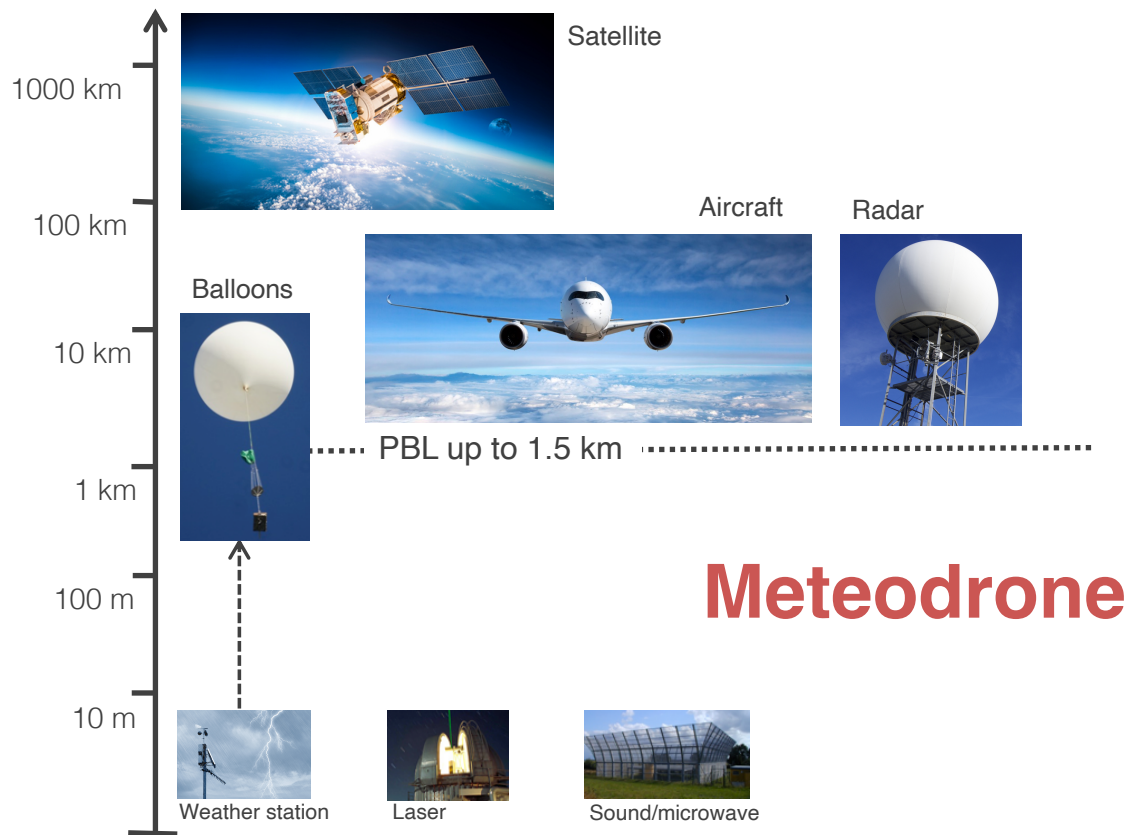
We are proud of Meteomatics' fair, hardworking, 'can-do' culture and a highly skilled multi-disciplinary team who rise to the challenge with our customers in a positive fashion. Creativity is a core skill whether it be in thinking, design, architecture or science.



Current Data Situation



Improving Data Situation




Meteodrone



Meteodrone Systems




Meteodrone SSE

Max. wind speed: 75 km/h
Flight altitude: 1'500 m AGL
Ø : 40 cm;  : 0.7 kg




Meteodrone Classic

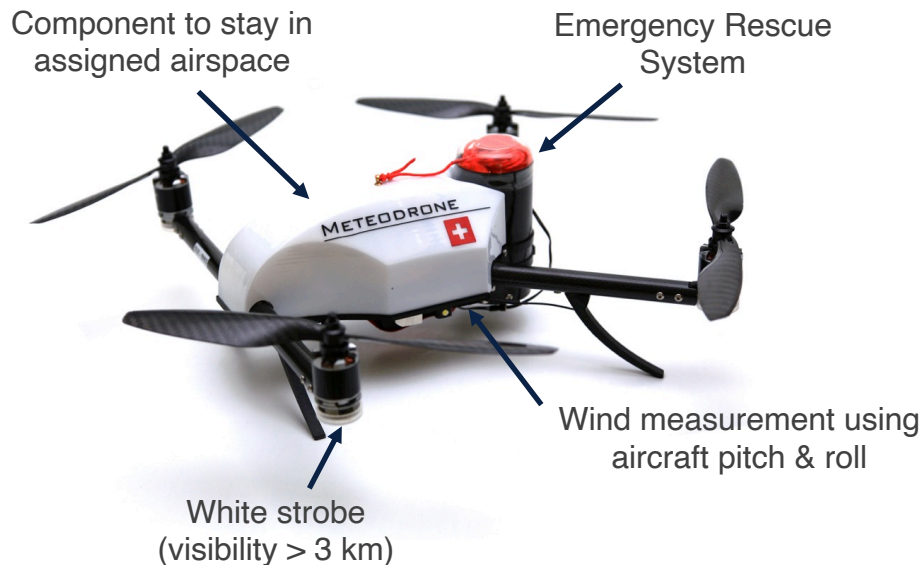
Max. wind speed: 60 km/h
Flight altitude: 3'000 m AGL
Ø : 60 cm;  : 1.5 kg



Meteodrone XL

Max. wind speed: 40 km/h
Flight altitude: 3'000 m AGL
Ø : 70 cm;  : 5 kg

Meteodrone Classic – BVLOS approved



> 2'500 Flight Hours

Under BVLOS Conditions

> 16'800 Vertical Profiles

> 1'500 SWISS1k Model Runs

Several Patents Filed & Awarded

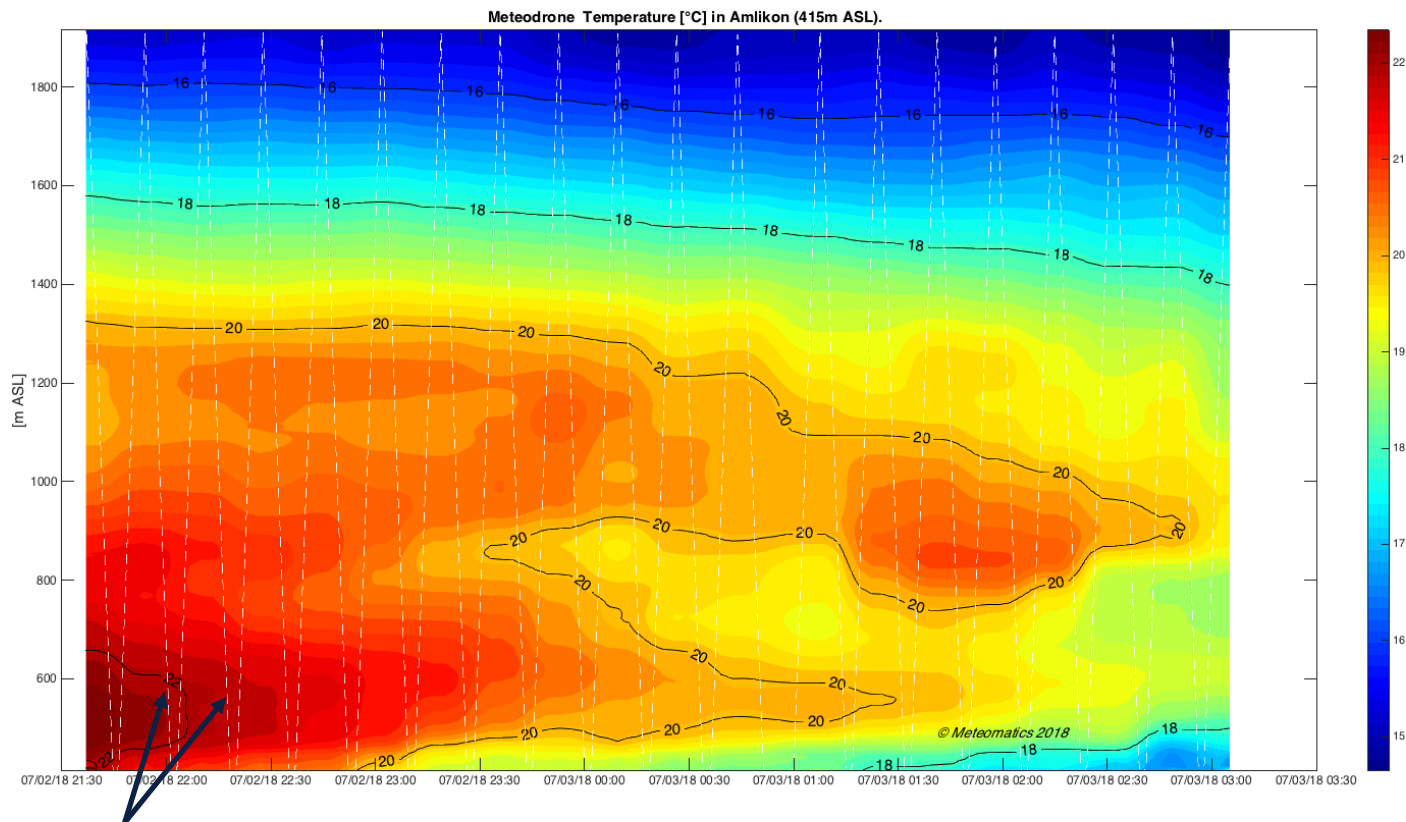
Meteobase – Remote Platform

Successor of Meteodrone Classic

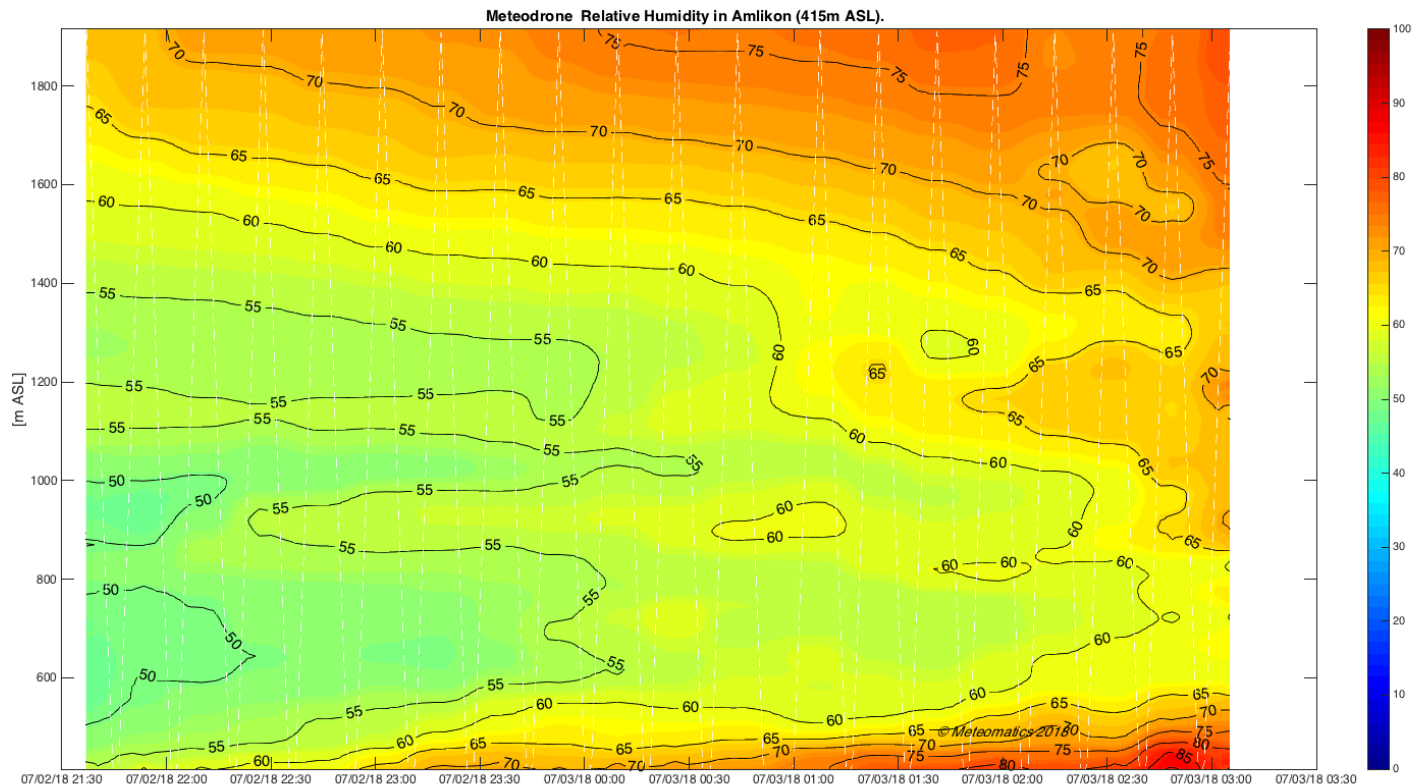
- Max. wind speed: 90 km/h
- Flight altitude: up to 6'000 m AMSL
- Ø : 80 cm
- M : 4.5 kg



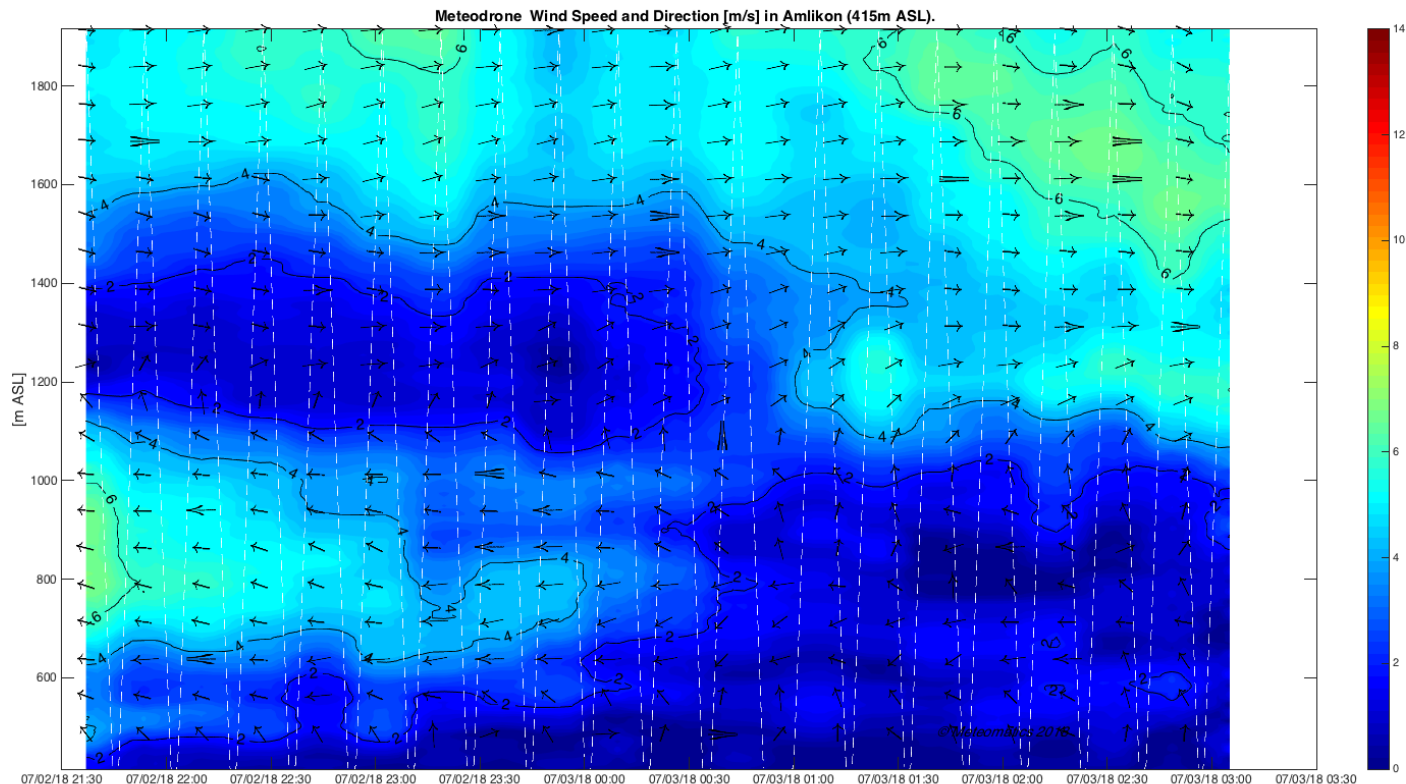
Amlikon 01. – 02.07.18: Temperature



Amlikon 01. – 02.07.18: Relative Humidity



Amlikon 01. – 02.07.18: Wind Speed and Direction

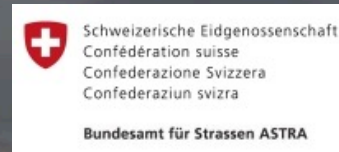


Project DETAF

DETAf (Drone Enhanced Terminal Aerodrome Forecasts)

- Operating drones in 6 locations in the vicinity of and at Zurich airport
- Feeding data in real-time into SWISS1k
- Sending visibility & ceiling forecasts to Skyguide

Funded by:

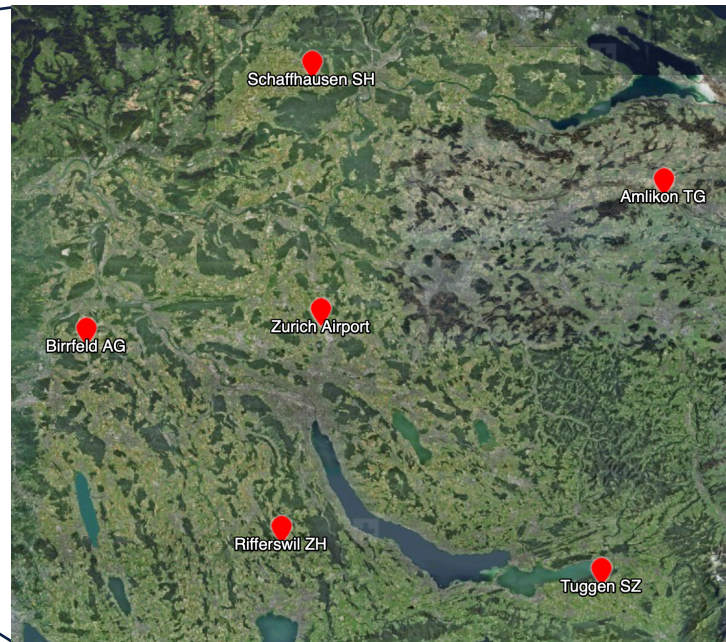
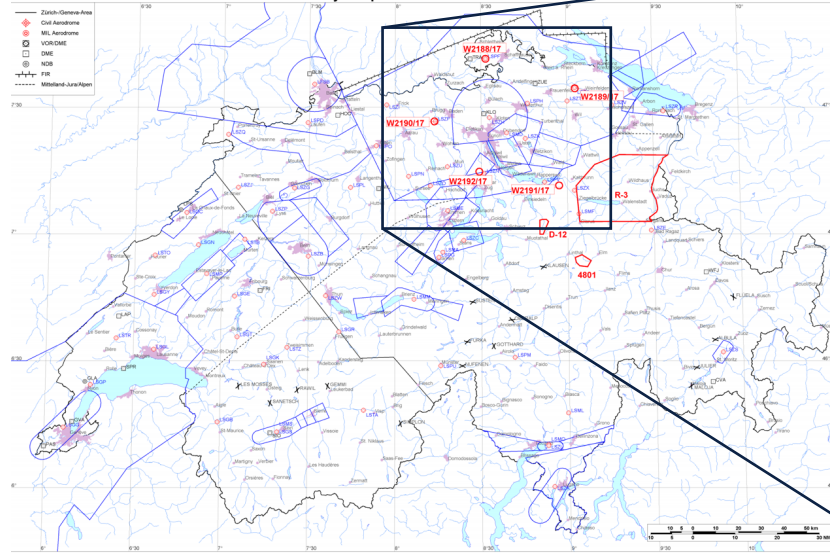


DETAF Setup

DABS Date: 2017 DEC 04

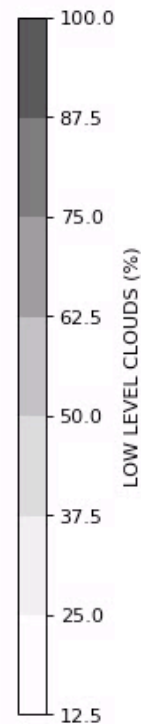
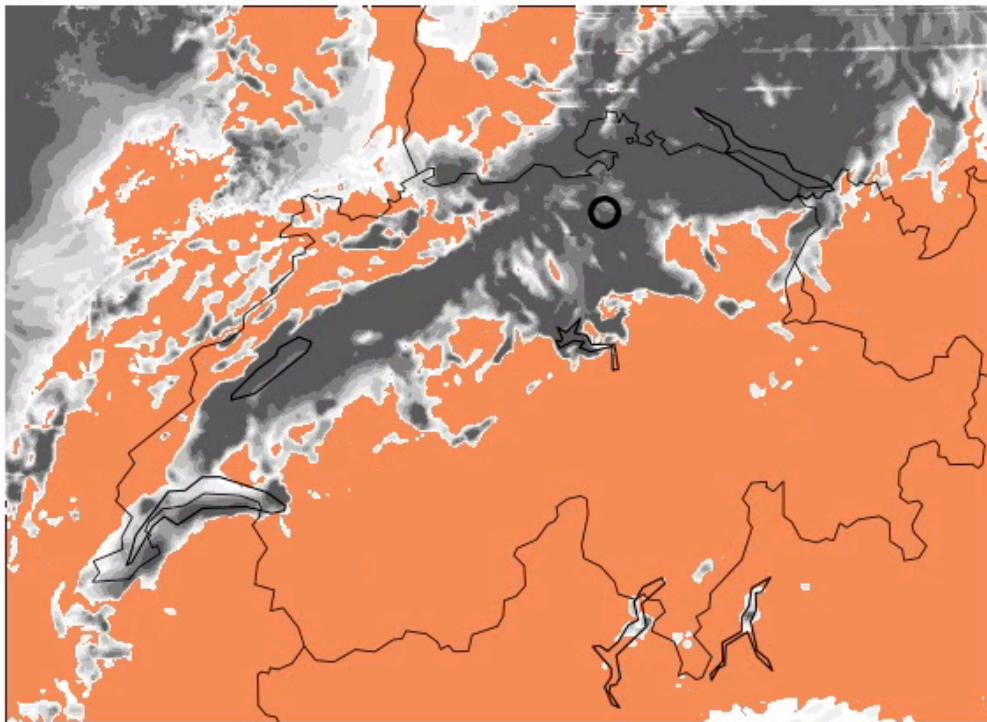
Daily Airspace Bulletin Switzerland

Version 1



SWISS1k – Fog & Low Clouds

Swiss-1k --- LOW LEVEL CLOUDS (%) --- INIT: 2017120618 FCST: 2017-12-06 18:40



Assimilation Experiments

- Collaboration with MeteoSwiss
- Use of the operational MeteoSwiss COSMO-KENDA system
 - 2.2 km grid size
 - LETKF (Local Ensemble Transform Kalman Filter)
 - 40 ensemble members
- Reference Experiment without Meteodrone Obs
- Experiment with Meteodrone Obs
- Meteodrone observations are fed into COSMO as additional AMDAR observations

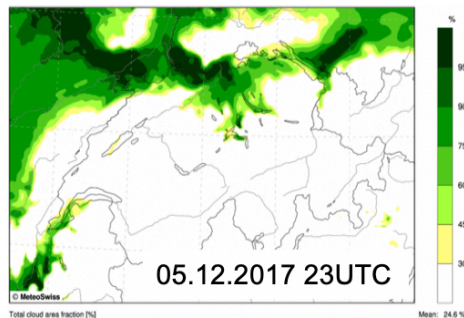
Summary of Results

Up to now only cloudiness has been investigated and subjectively compared with a cloud product from MSG Satellites.

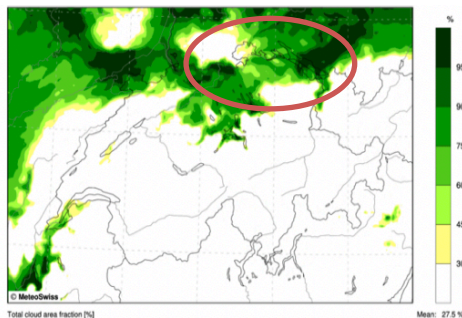
Date	Weather Situation	Impact on COSMO cloud analysis	Duration of cloud forecast impact
2017-12-05	High pressure system, low Large-Scale Forcing	Positive	< 3h
2017-12-06	High pressure system, low LSF	Strongly Positive	12h
2018-02-13	Border of high pressure system, medium LSF	Neutral	-
2018-02-14	Border of high pressure system, medium LSF	Neutral	-
2018-02-15	Frontal passage, strong LSF	Neutral	-
2018-02-26	Border of high pressure system, medium LSF	Neutral	-
2018-02-27	Border of high pressure system, low LSF	Strongly Positive	< 3h

Impact on Analysis Mean Cloudiness

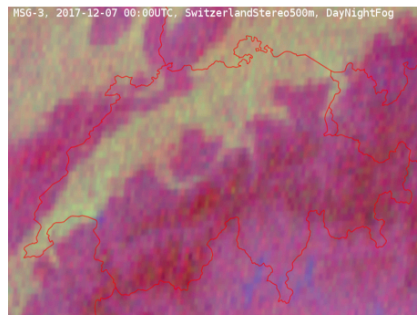
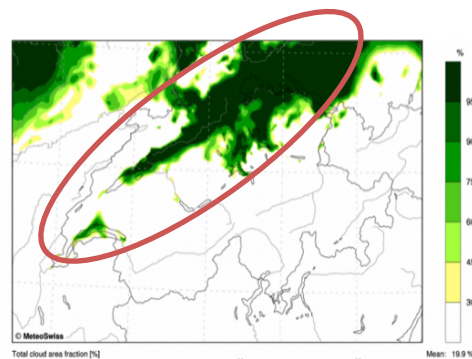
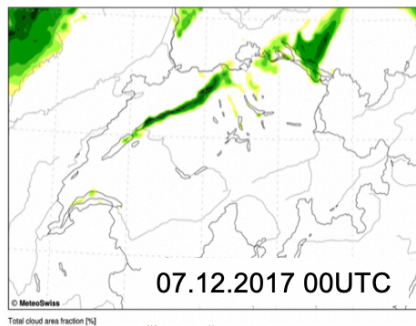
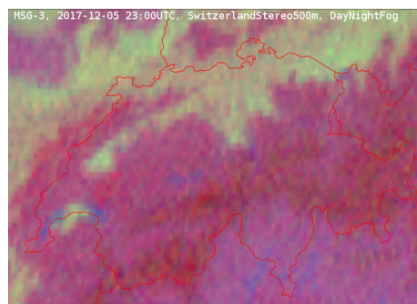
Without Meteodrones



With Meteodrones

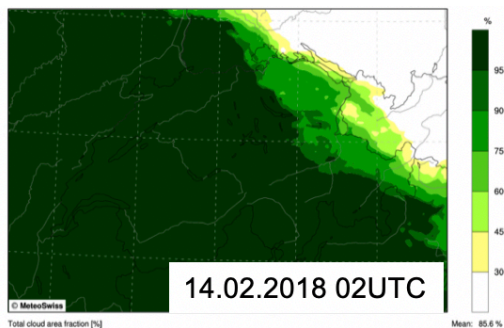


Satellite Observation

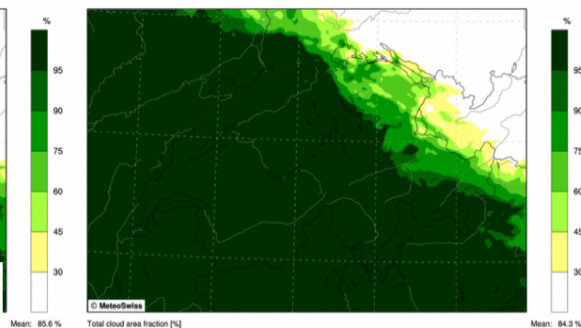


Impact on Analysis Mean Cloudiness

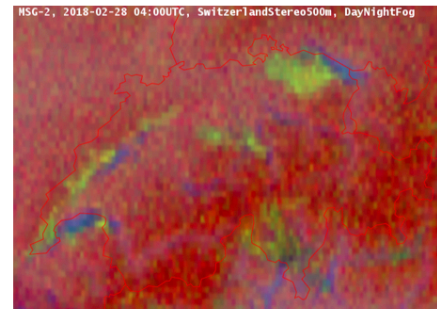
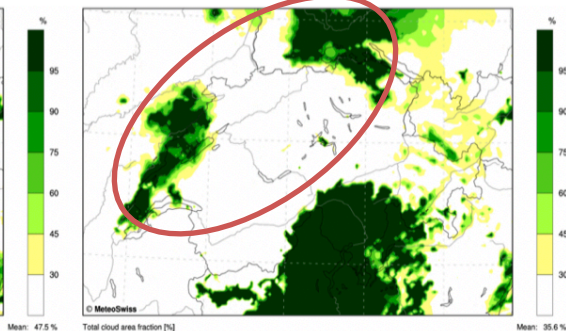
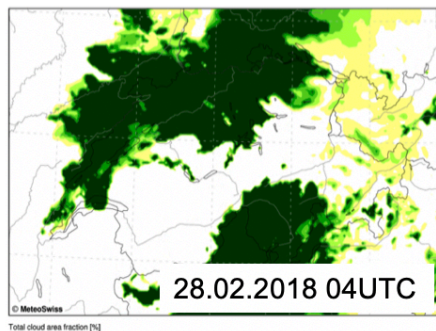
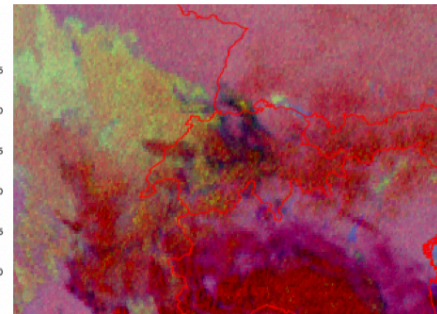
Without Meteodrones



With Meteodrones



Satellite Observation



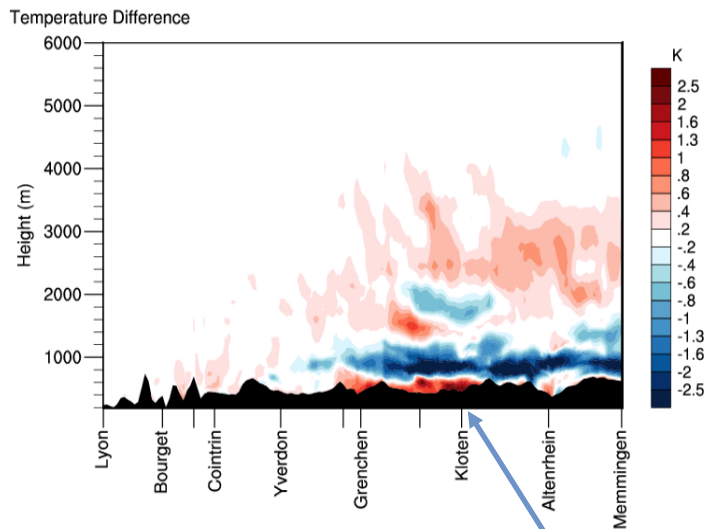
Vertical Cross Section of Analysis Differences



Source: Leuenberger et al., 2020: Improving High-Impact Numerical Weather Prediction with Lidar and Drone Observations, BAMS (in press)

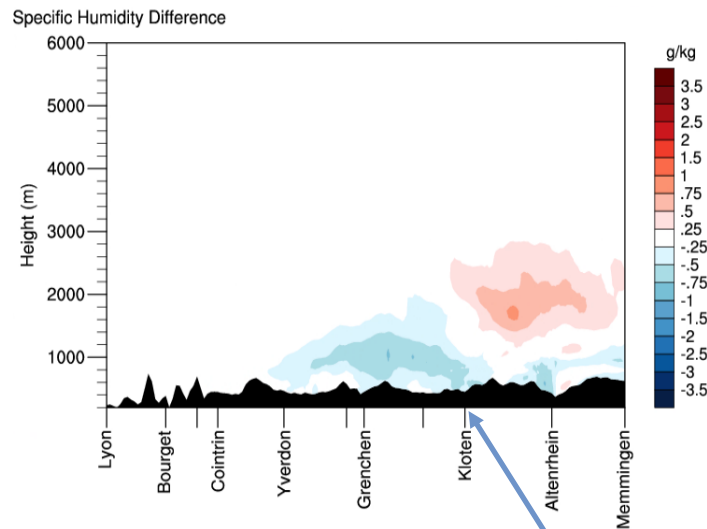
Impact of Meteodrones on T and QV

2017-12-07 03 UTC, after 5 hourly assimilation updates



Meteodrones cool

Meteodrones heat



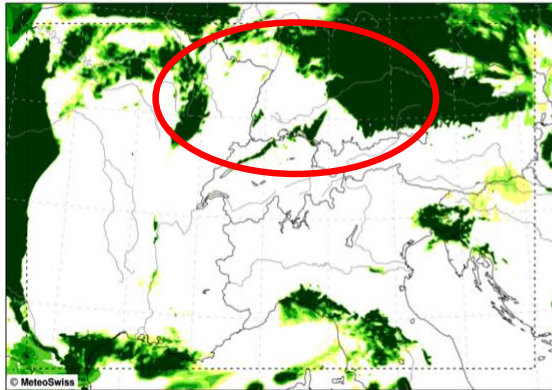
Meteodrones moisten

Meteodrones dry

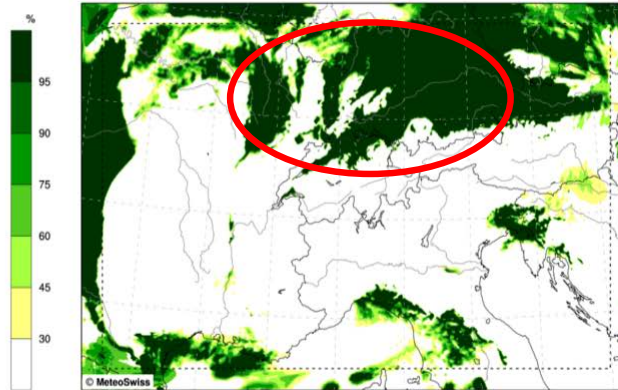
Forecasts of Cloudiness

2017-12-07 00 UTC +00h

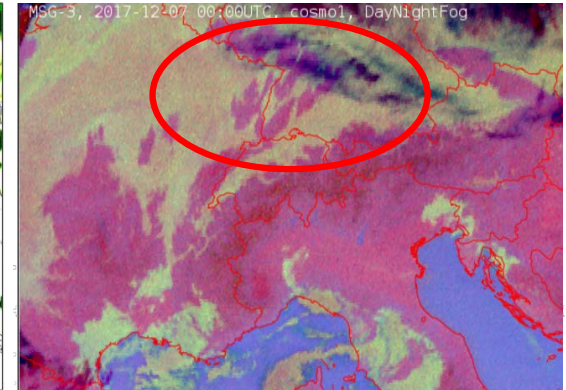
Without Meteodrones



With Meteodrones



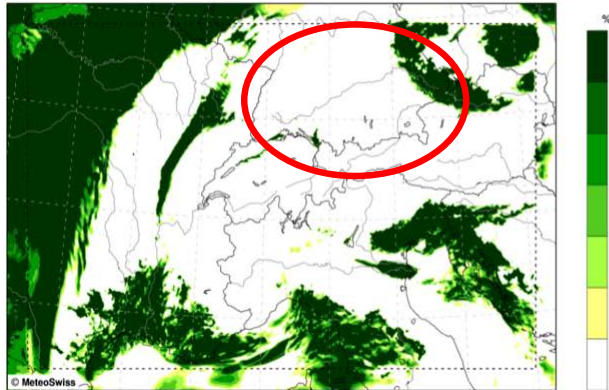
Satellite Observation



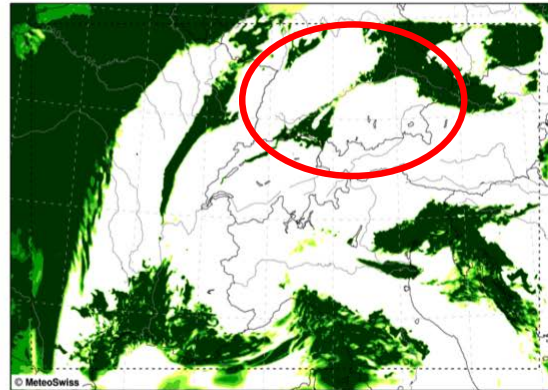
Forecasts of Cloudiness

2017-12-07 00 UTC +05h

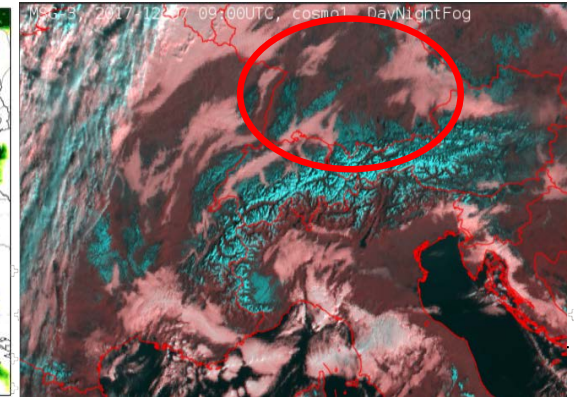
Without Meteodrones



With Meteodrones



Satellite Observation



Conclusion

- Meteodrones profiles have a very positive impact on high-res model forecasts
- In one investigated case the cloud forecast impact lasts up to +12h
- It demonstrates the importance of PBL T and RH observations in fog situations
- No negative impact has been found in the 7 cases under investigation
- Most positive impact was found in cases of weak large-scale forcing (as expected)

An extension of the Meteodrone network will further improve hyperlocal weather forecasts!

Thank You for Your Attention!



Your Contact

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