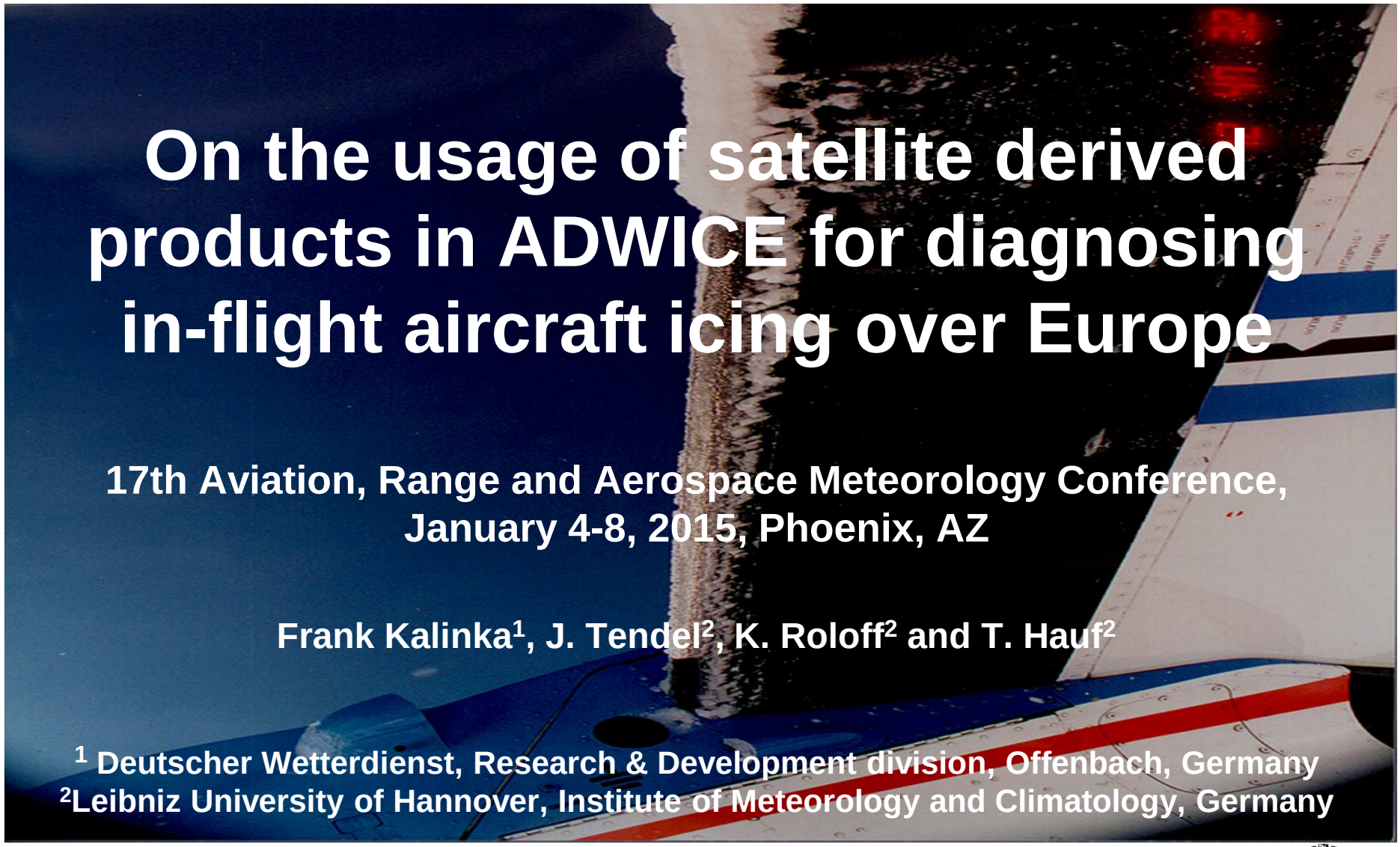

On the usage of satellite derived products in ADWICE for diagnosing in-flight aircraft icing over Europe

17th Aviation, Range and Aerospace Meteorology Conference, January 4-8, 2015, Phoenix, AZ

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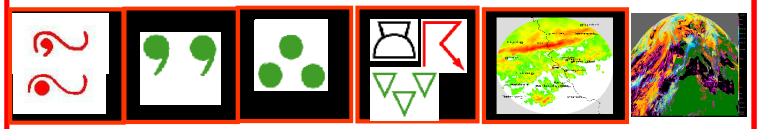
Why do we need a Post-processing like ADWICE?

- Risk/Intensity of icing is proportional to
  - Amount & size of supercooled large droplets (SLD)
- But no direct (or insufficient) information of SLD from NWP (here: COSMO-EU)!
- Therefore, other techniques must be used:
  - e.g. ADWICE

Diagnostic Icing Algorithm (ADWICE DIA)

PIP (3D) as „first guess“

<u>Observational data (2D)</u>
SYNOP/METAR & RADAR +
SATELLITE (www.nwcsaf.org)



<u>Catalog for icing scenarios</u>
(Confirm/reject PIP and identify possible icing risk)

Freezing | *Stratiform*
Convective | *General*

Icing scenario

Severe | *Moderate*
Light

Icing intensity
(fuzzy logic)

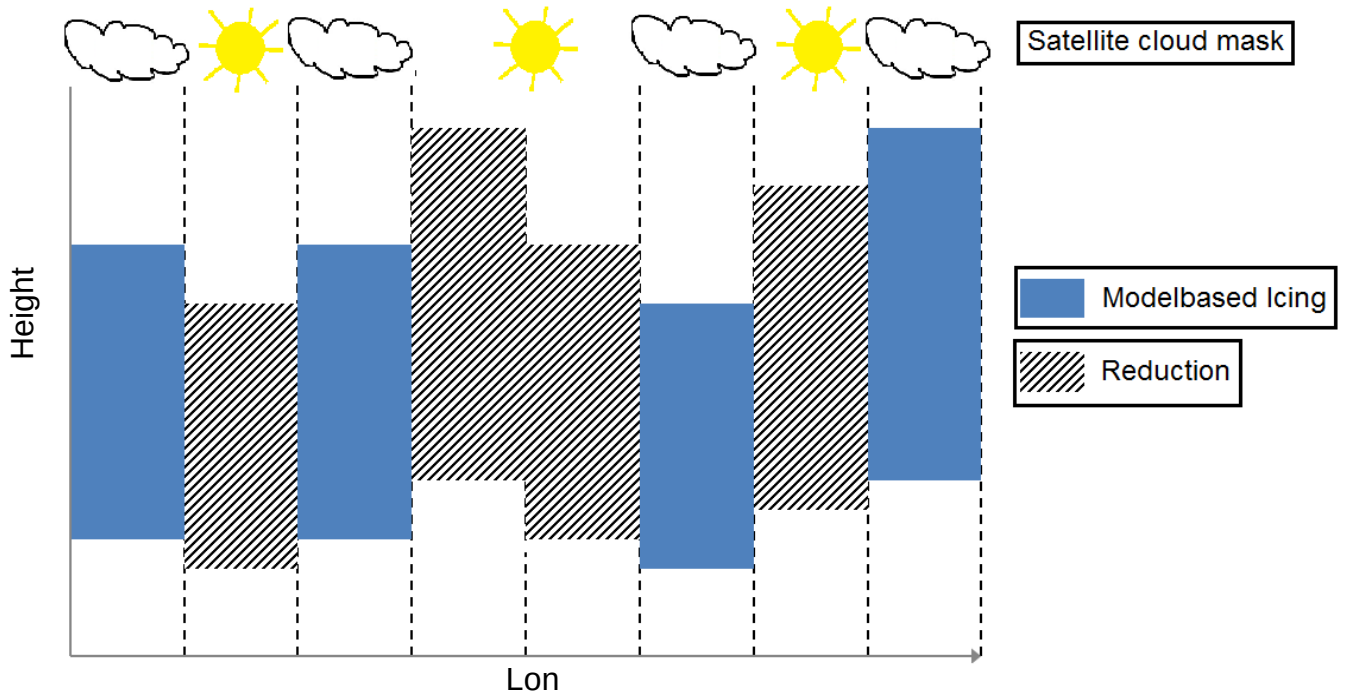
Diagnostic Icing Product (DIP)

Roloff et. al., in preparation: The German In-flight Icing Warning System ADWICE for European Airspace – Current Structure, Recent Improvements and Verification Results

Satellite Products (www.nwcsaf.org):

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

Cloud-Mask:



Reduction of Icing

Satellite Products (www.nwcsaf.org):

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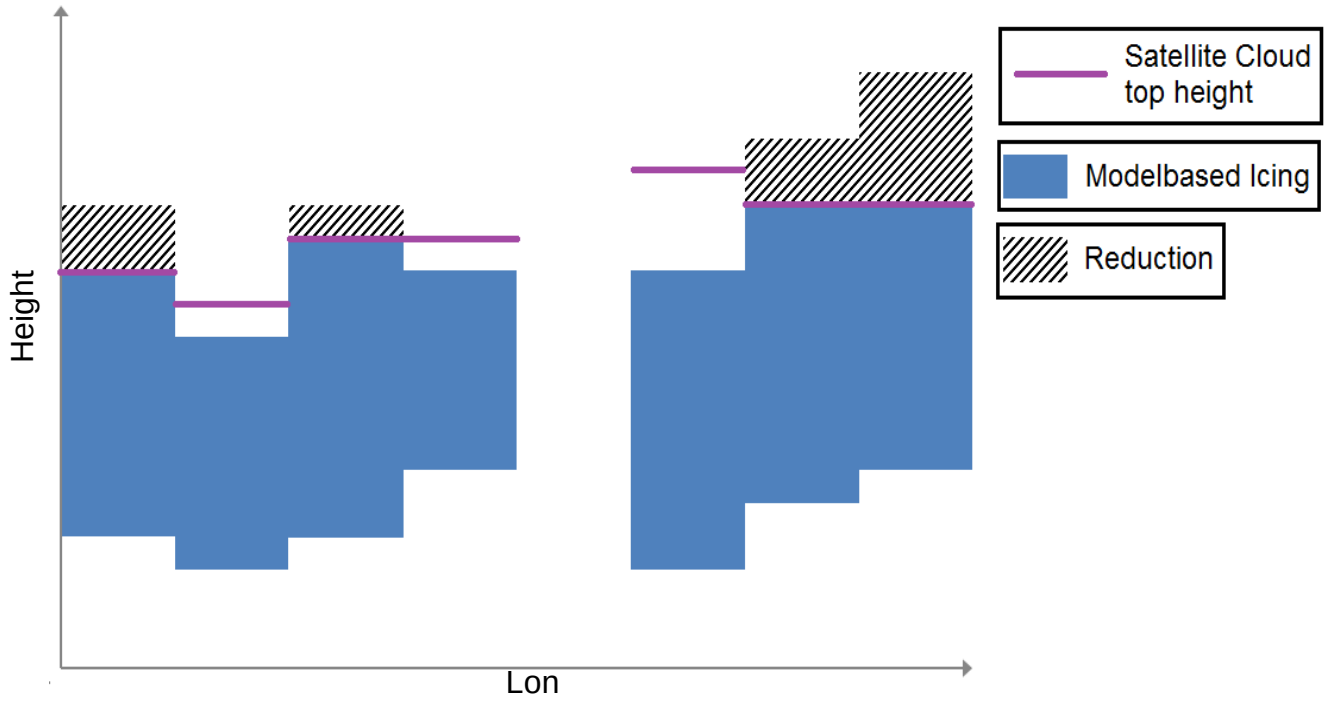
Wetter und Klima aus einer Hand

Cloud-Top-Height:



Reduction/Height correction of Icing

Satellite Products (www.nwcsaf.org):

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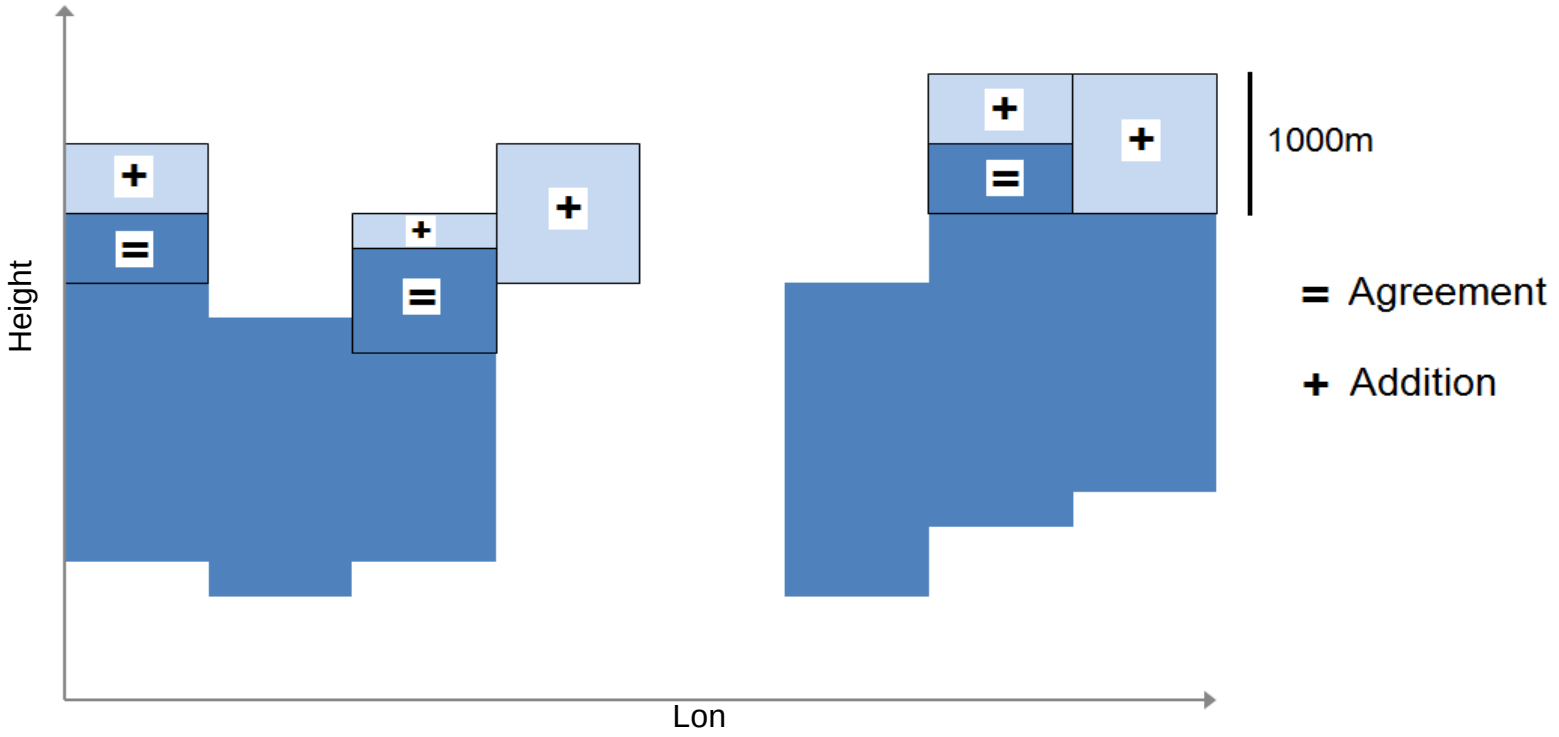
Combination of Cloud-Top-Temperature, Cloud Phase & Cloud Mask:

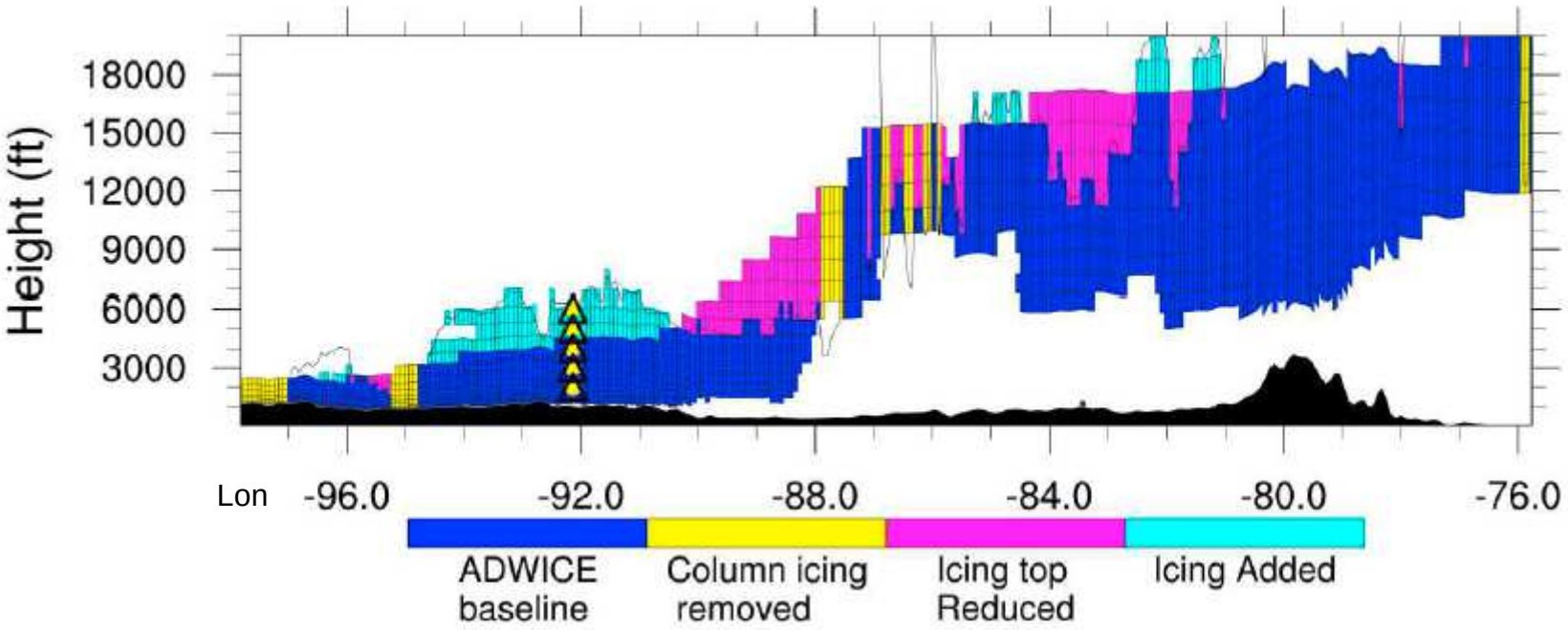
- CTT = -20°C < T < 0°C
- Cloud Phase = Liquid
- Cloud Mask = True

} general icing risk from cloud top to -1000m

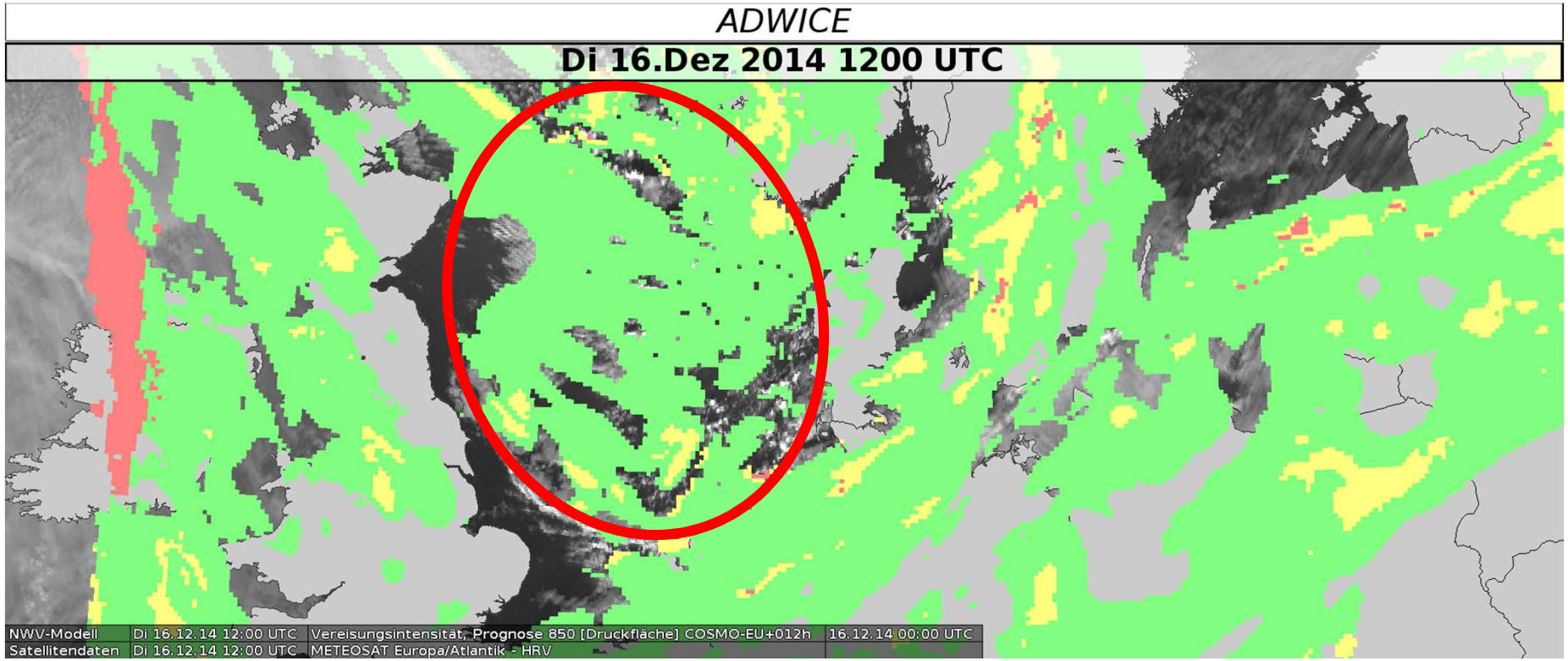


Addition of icing / agreement of icing

Example: cross-section

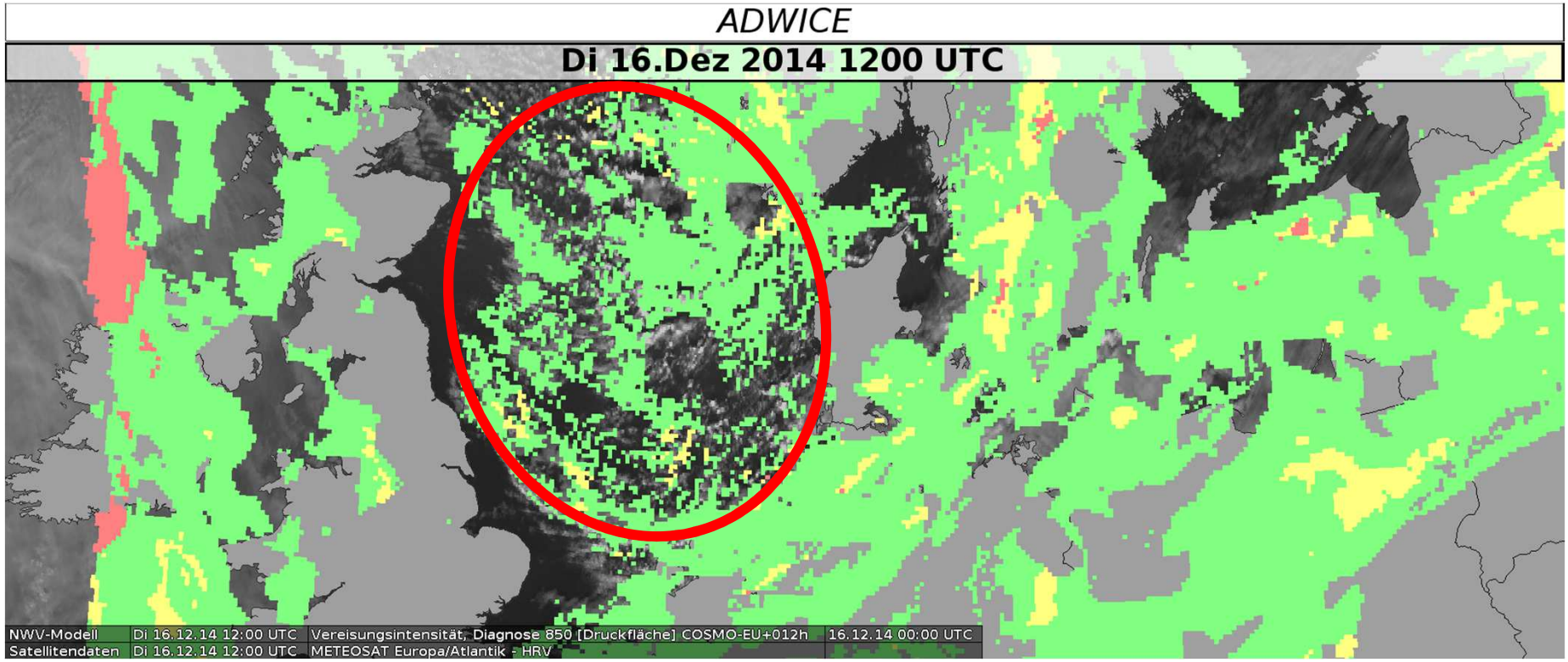


Example: Icing Intensity (Prognosis)



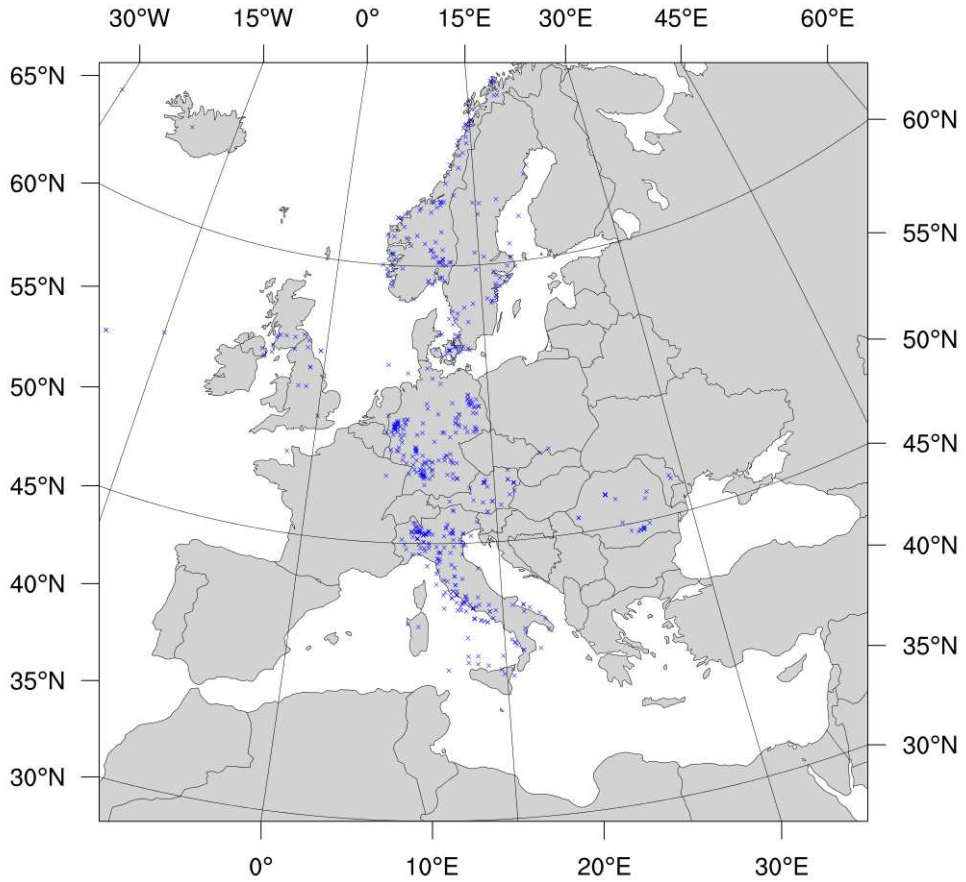
Deutscher Wetterdienst
Wetter und Klima aus einer Hand

Example: Icing Intensity (Diagnosis with Sat-Data)



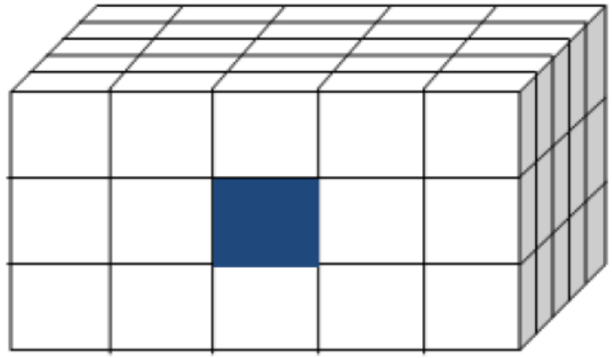
Verification: Model vs. PIREPs

- 472 PIREPs from Oct–Dez 2013
- Hereby:
  - 458 Icing
  - 14 „no icing“

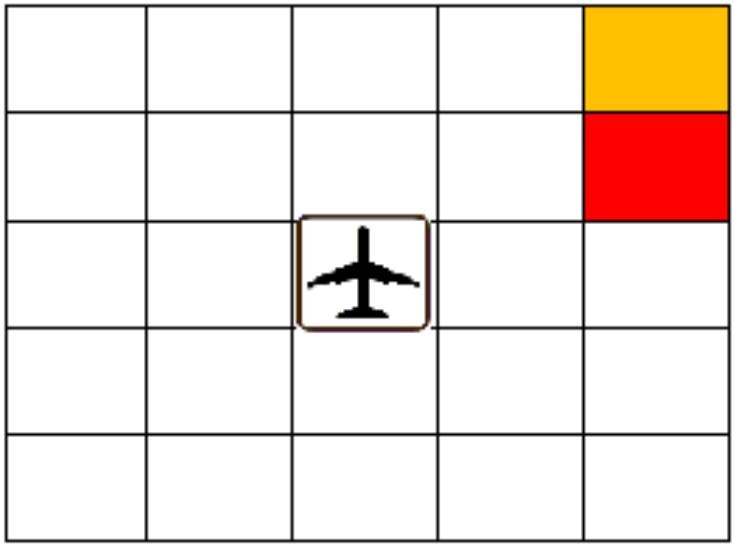


Verification with PIREPS

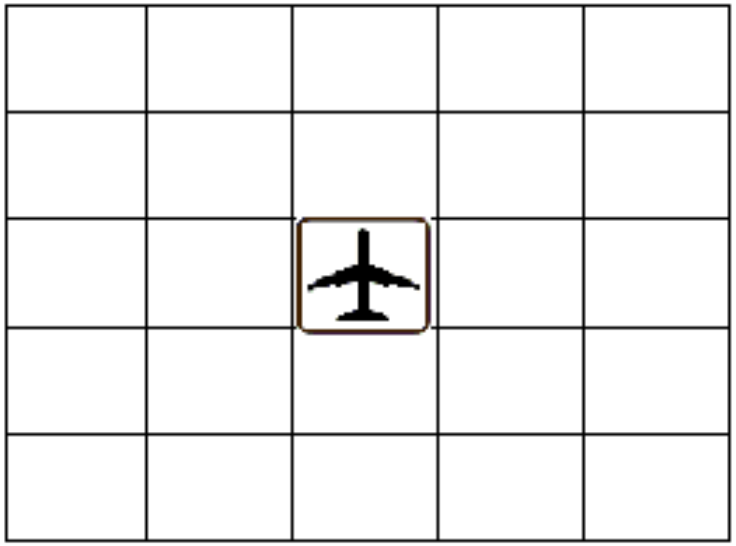
- PIREPS are inaccurate in time and location (horizontal and vertical)
- Icing degree (LGT, MOD, SEV) is subjective and depends on type of aircraft
- Therefore: Maximum of forecasted / diagnosed icing intensity in a model-cube was compared to the related PIREP/AIREP:



„ A320 REP MOD ICE BTN FL100 AND FL190 BTN VENEZIA AND VIC REP AT 11.00“



„HIT“



„MISS“

Verification Results for Europe

	Hit-Rate	1-False-Alarm-Rate	Vol%	Area under curve
PIP	86,65	66,67	11,15	0,7666
DIP (without Sat-data)	83,43	71,43	10,18	0,7743
DIP (with Sat-data)	83,23	71,43	8,77	0,7733

- Vol % = number of GP with diagnosed icing / number of all model GP

- Verification study over USA shows similar results (Tendel, 2013)

Conclusion

The implementation of satellite derived products into the ADWICE-Diagnosis leads to a reduction of grid-points diagnosed with icing by >16%, while Hit-Rate do not degrade!

Outlook

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

➔ Global setup of ADWICE-Prognosis ICON-Model: