



# **Windshear at Nice and Clermont-Ferrand : Météo-France's studies and operational equipments.**

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Cizalladura del viento en aeropuertos y presentación del programa E-AMDAR, A.I. Reina Sofía –Tenerife Sur, Islas Canarias

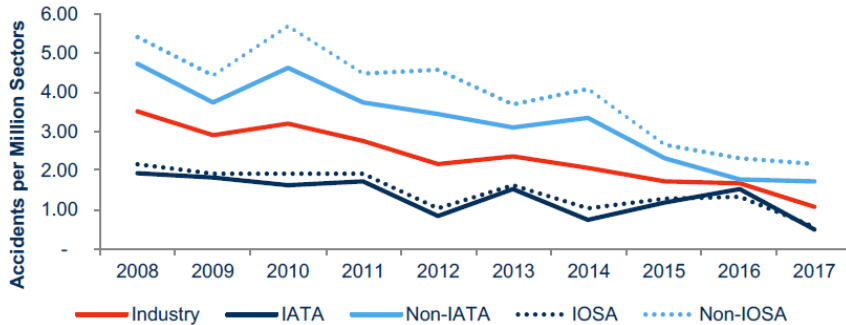
# Windshear : an aviation safety issue

(IATA safety report, 2017)

## ALL ACCIDENTS

'All Accidents' is the most inclusive rate, including all accident types and all severities in terms of loss of life and damage to aircraft.

### Jet & Turboprop Aircraft



## 2013-2017 Aircraft Accidents



### THREATS

	Percentage Contribution
Meteorology	29%
Aircraft Malfunction	20%
Wind/Wind shear/Gusty wind	16%
Gear/Tire	15%
Airport Facilities	13%
Maintenance Events	12%
Poor visibility/Instrument Meteorological Conditions	11%
Lack of Visual Reference	10%
	0%

### Recommendations to airports:

- Provide a meteorological office that issues alerts of low-level wind shear and turbulence within three nautical miles of the runway thresholds for relay by air traffic controllers to approaching and departing aircraft.

# Meteo-France's efforts on wind shear detection



Roissy-Charles de Gaulle (LFPW - CDG)  
• X-Band Doppler Radar

Clermont-Ferrand Auvergne (LFLC – CFE)  
• Technological testing (UHF profiler)  
• Process documentation  
• Forecasting evaluation

Nice Côte-d'Azur (LFMN - NCE)  
• X-Band Doppler Radar  
• Doppler Lidar (work in progress)



# Nice Côte-d'Azur (LFMN – NCE)

(5.8 M Pax/y 175 k Movements/y)



(source : @AeroportNice)



# Nice Côte-d'Azur

An aerial photograph of the Nice Côte-d'Azur airport and its surroundings. The airport is a long, narrow strip of land extending into the sea. The city of Nice is visible to the west and south of the airport. The coastline is rugged and irregular. In the background, there are mountains with snow-capped peaks under a clear blue sky.

**Rugged coastline**

**Non-uniform sea breeze / land breeze  
cycle**

**Average speed : 2 - 12 kt (4 - 20 km/h)**

(source : @AeroportNice)



# Nice Côte-d'Azur

Hills nearby

• vertical cross-section



Dénivelé positif : 715,22 m - Dénivelé négatif : -1 736,68 m  
Pente moyenne : 16 % - Plus forte pente : 59 %

Undulatory,  
non-uniform wind fields

(source : @AeroportNice)



# Nice Côte-d'Azur

- vertical cross-section 13 km inland



Dénivelé positif : 1 348,84 m - Dénivelé négatif : -1 632,9 m  
Pente moyenne : 22 % - Plus forte pente : 64 %

The outflow of the Var valley

Average speed : 6 to 10 kt (10 to 18 km/h)

Maximum speed 18 kt (30 km/h) at the end of winter season

(source : @AeroportNice)



# Nice Côte-d'Azur

An aerial photograph of Nice, France, showing the city, the airport, and the surrounding mountains. The city is built on a hillside overlooking the sea. The airport is located on a peninsula in the foreground. The mountains in the background are covered in snow.

**Mountains not so far**  
(3300 m ASL 60 km away)

**Convection-prone area**  
storm : 29 days per year

**Wind gusts over 60 km/h 40 days per year**  
Maximum frequency in April by clear weather

**Maximum wind gust speed : 120 km/h**  
Max. frequency in August and December



# Nice Côte-d'Azur (LFMN – NCE)

## Specific phenomena « La renverse »

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- Wind reverse : quick wind inversion of 180 degrees
  - Wind speed from 15 to 25 kt (30 à 45 Km/h) from east to west
  - Any season concerned
  - Occurs on any strong wind situation
  - Synoptic wind from south-west
  - over 20 kt (35 km/h)
  - In upper layer 1000-2000 m



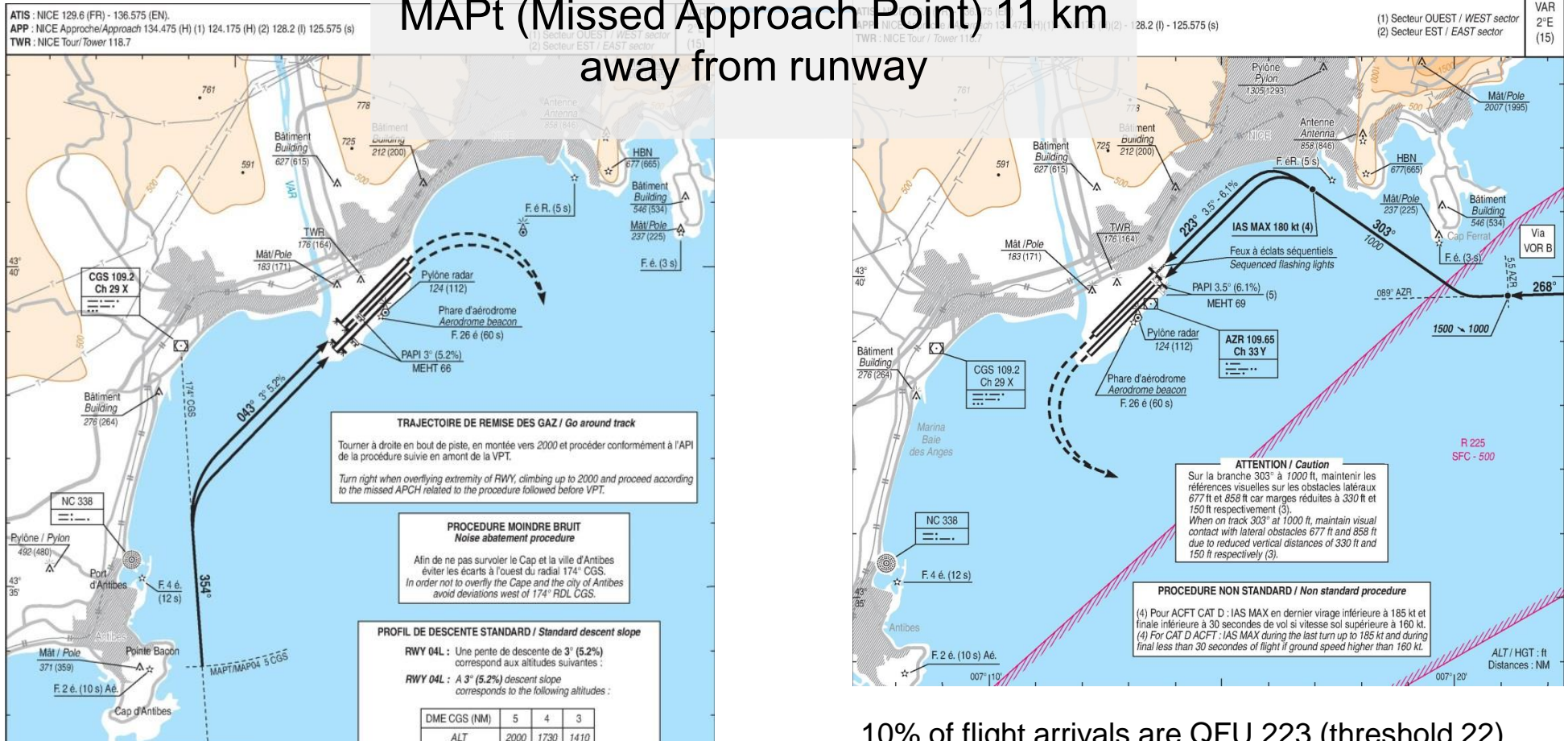
# Nice Côte-d'Azur (LFMN – NCE) will you land as you wish ?





# Difficulties must be anticipated

MAPt (Missed Approach Point) 11 km away from runway

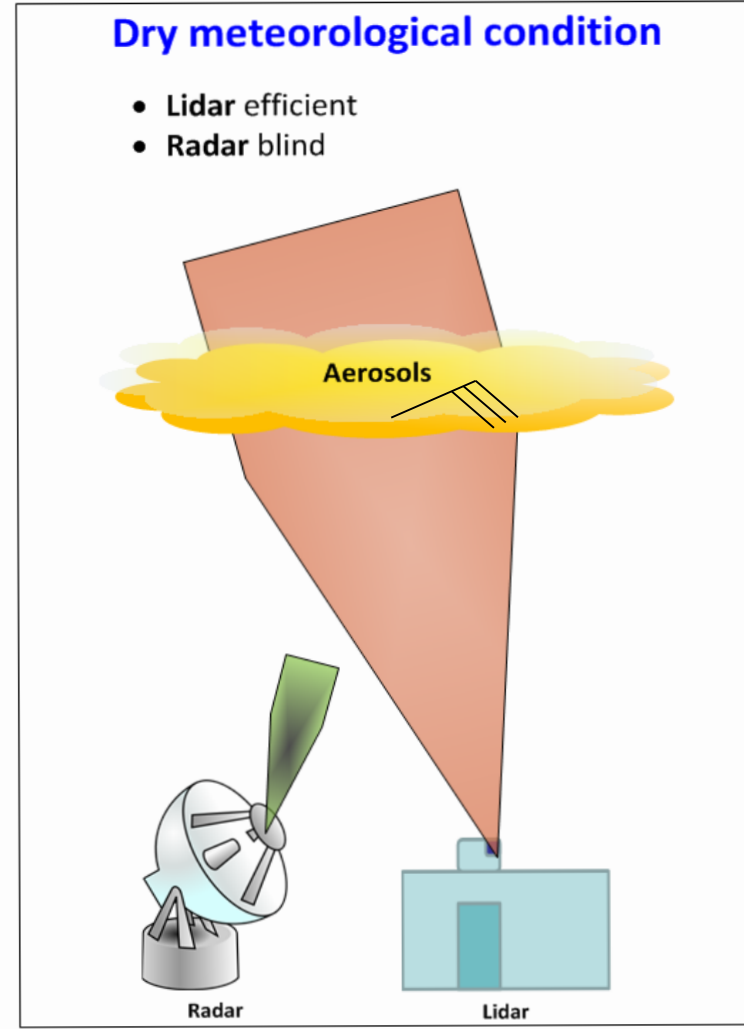
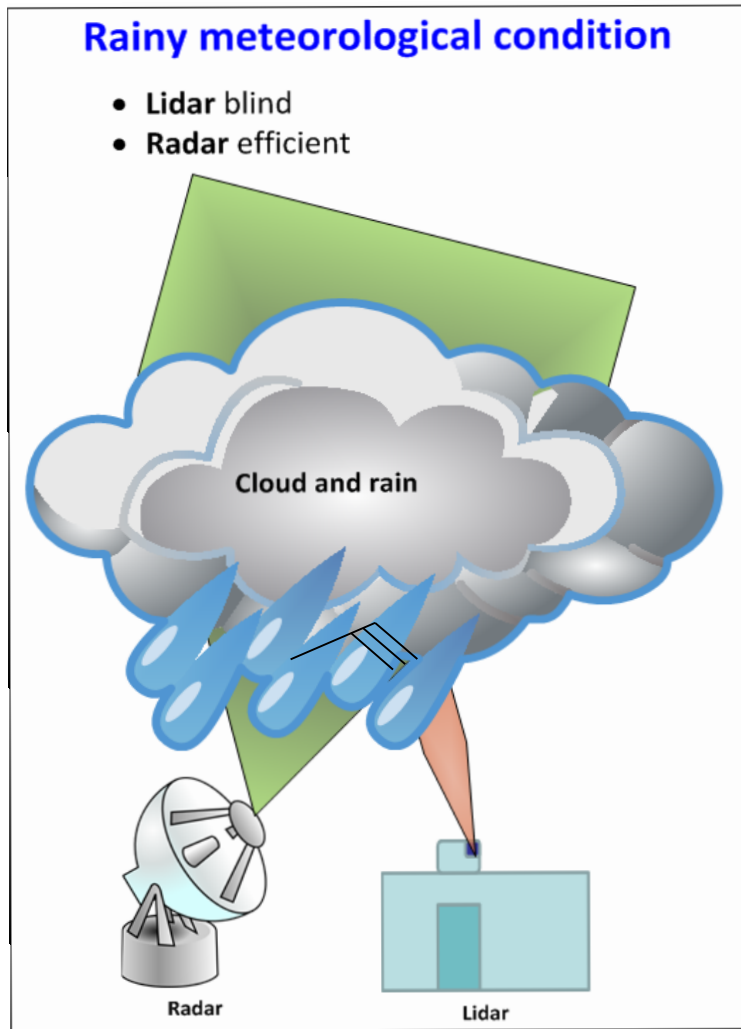


90% of flight arrivals at Nice-Côte d'Azur are QFU 043 (threshold 04)  
 Two thirds of these arrivals are subject to noise abatement procedures

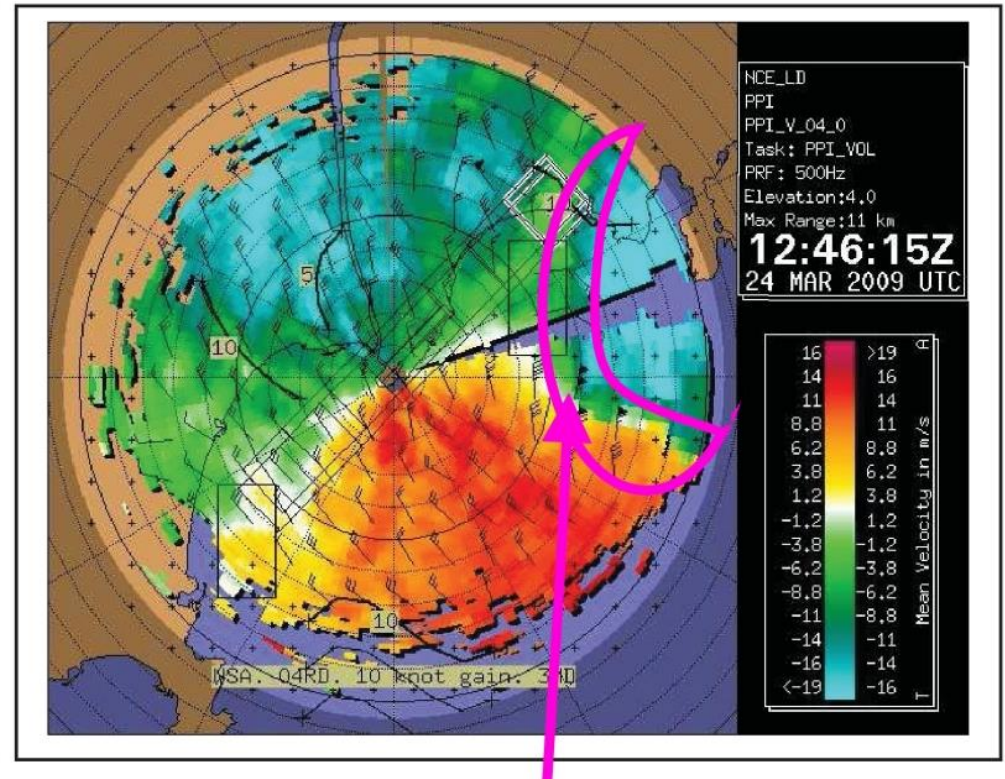
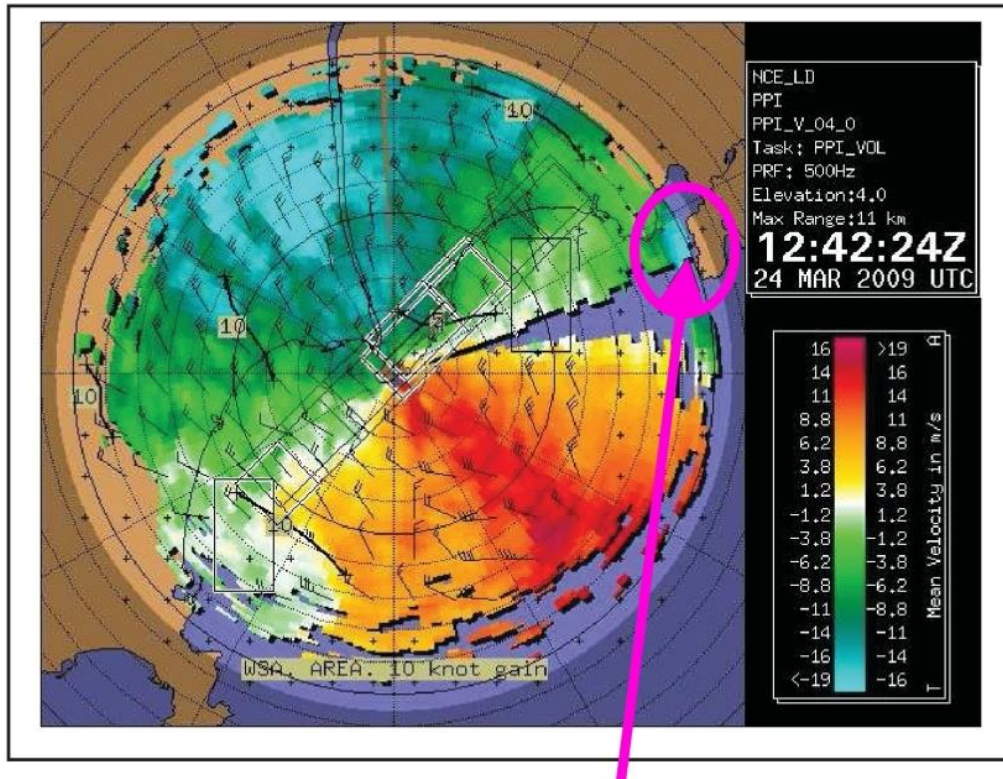
10% of flight arrivals are QFU 223 (threshold 22).



# Need for complementary measurements



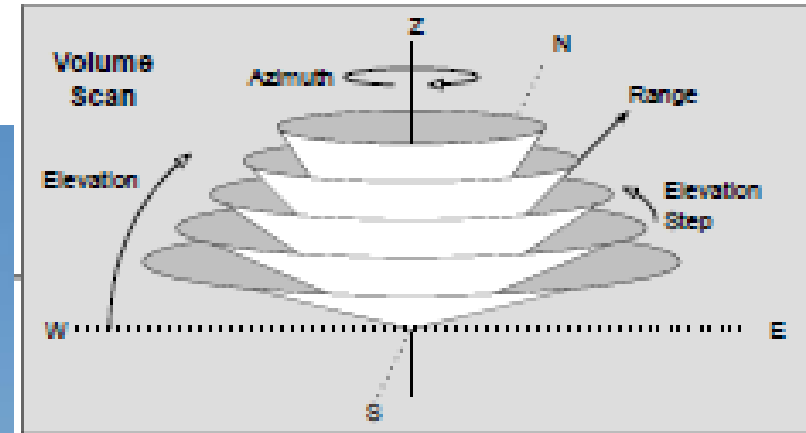
# Need for frequent update cycle : fast-moving wind shear





# X-Band Doppler Radar

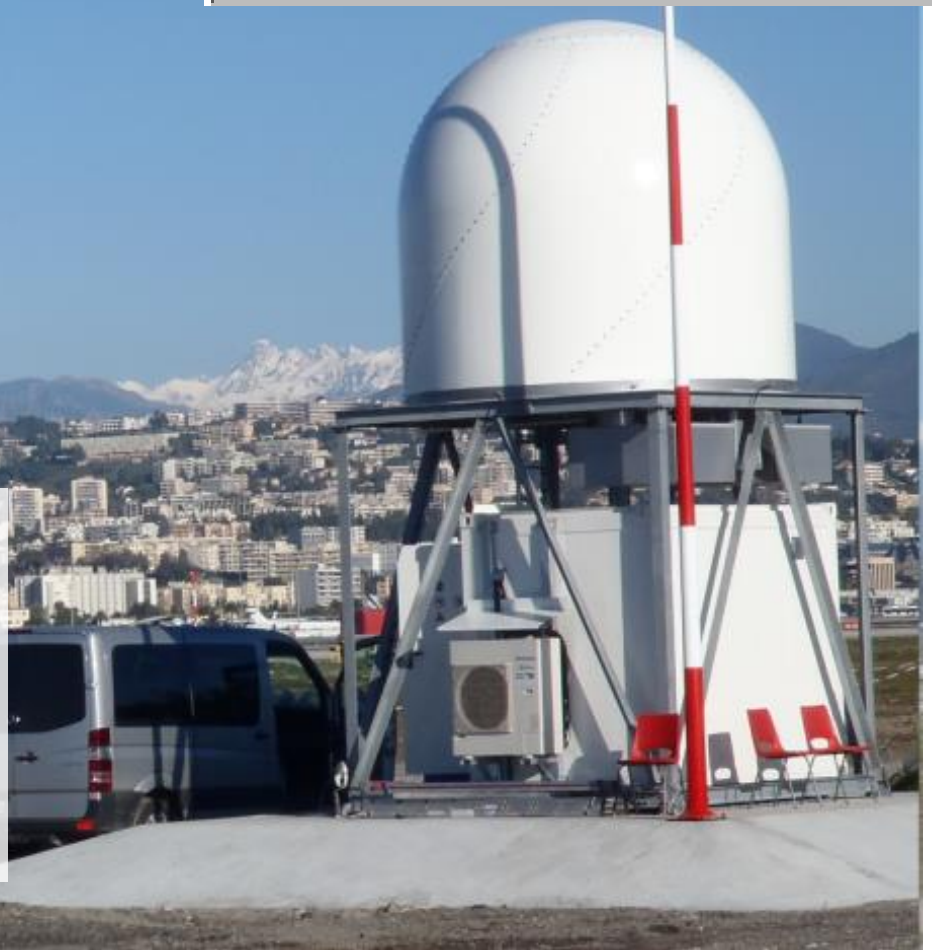
Selex / METEOR 60DX CDP  
Installed in 2015/04  
Operational since 2017/03



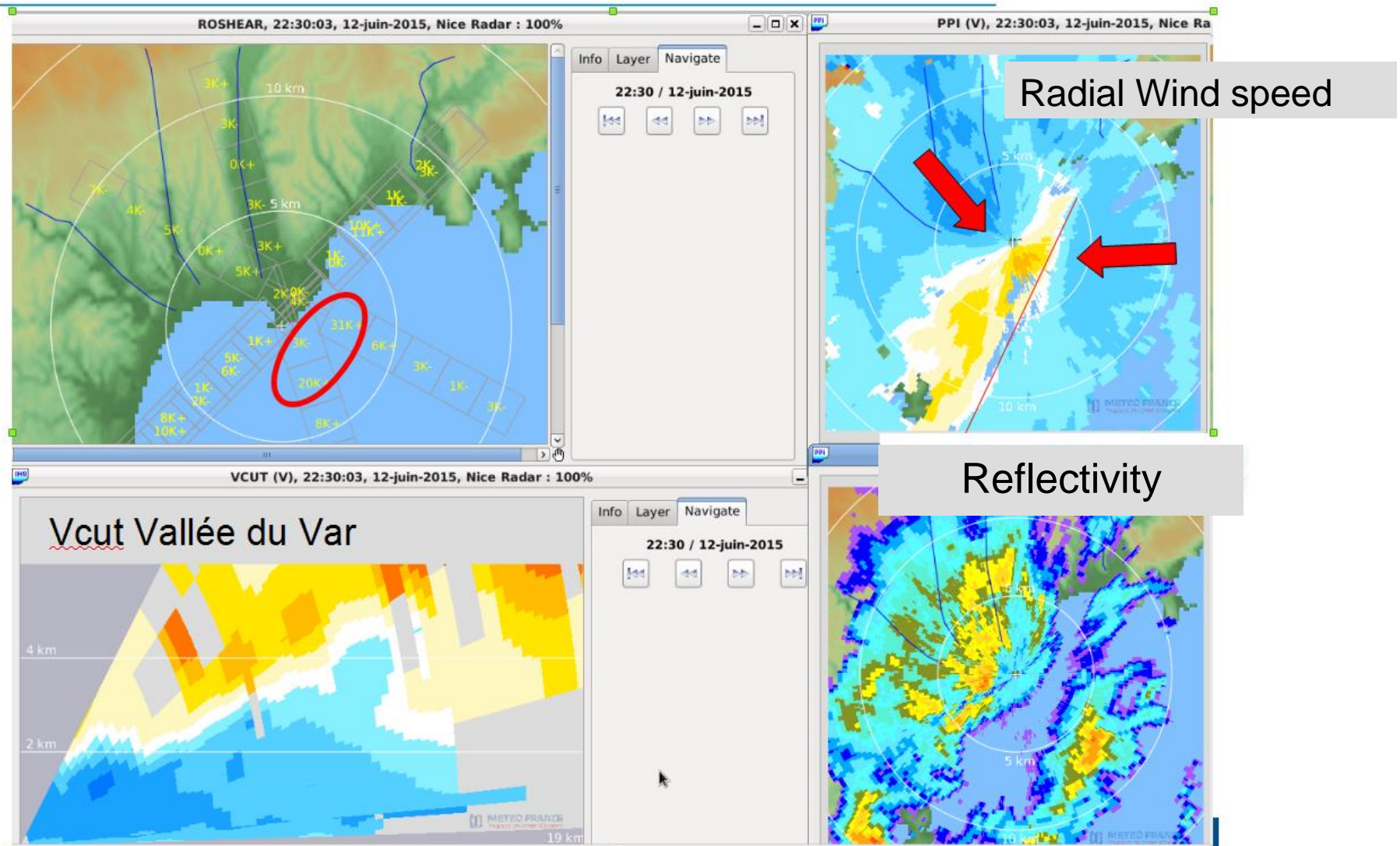
- 11 elevation steps from  $1^{\circ}$  to  $50^{\circ}$
- Every 289 seconds (4' 49")

Selex RAINBOW software provides :

- Wind shear products
- Operational observation data (rain, snow, hail)



# Nice : X-Band Doppler radar example





# Nice : X-Band Doppler radar usage : testing the provision of windshear information

 <p>Service de l'Information Aéronautique</p> <p>D S N A</p>	<p><b>SERVICE TECHNIQUE</b></p> <p>☎ : 05 57 92 57 57</p> <p>Fax : 05 57 92 57 77</p> <p>✉ : sia-direction@aviation-civile.gouv.fr</p> <p>Site SIA : <a href="http://www.sia.aviation-civile.gouv.fr">http://www.sia.aviation-civile.gouv.fr</a></p>	<p><b>AIC FRANCE</b></p> <p><b>A 05/18</b></p> <p>Date de publication : 25 JAN</p>
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**OBJET : Expérimentation de la fourniture aux équipages des informations de cisaillements de vent (en situation pluvieuse) à Nice - Côte d'Azur (LFMN).**

Cette AIC annule et remplace l'AIC 04/17

## 1 INTRODUCTION

Un cisaillement de vent correspond à une variation en force et/ou direction de vent sur de faibles distances verticales ou horizontales.

Les cisaillements représentent un danger pour la conduite des vols, particulièrement lors des phases de décollage, de montée initiale, d'approche finale et d'atterrissage.

L'environnement aérologique niçois étant propice à la présence de cisaillements, un dispositif de détection de cisaillements de vent en situation pluvio-convective a été mis en place par Météo-France sur l'aérodrome Nice - Côte d'Azur.

- ☛ Ainsi, une phase expérimentale visant à l'amélioration de l'information de cisaillements en situation pluvieuse apportée aux équipages à proximité de l'aérodrome de Nice est prévue **jusqu'au 31 décembre 2018**.

## 2 DIFFUSION DES INFORMATIONS DE CISAILLEMENTS

- Sur l'ATIS  
Les avertissements de cisaillements seront reportés sur l'ATIS (sans toutefois en préciser la localisation et l'intensité du fait du caractère évolutif du phénomène).
- Sur la fréquence de contrôle appropriée  
Les alertes de cisaillements seront annoncées par le contrôleur aux aéronefs sur la fréquence de contrôle. Elles reprendront les informations fournies par Météo-France, précisant le cas échéant la localisation et l'intensité.

# Nice Doppler Lidar : specification

- System availability : 95 %
- Range is at least 11 km (distance at which the detection rate is 80%) under the following atmospheric conditions :
  - $10 \text{ km} < \text{Visibility} < 50 \text{ km}$
  - No rainfall for 30 minutes beforehand and 1 hour afterwards
  - Cloud base and boundary layer height above 600 m
  - $T < 25^\circ\text{C}$  in the shade

## Scanning mode :

- 1 PPI at an elevation of 3 degrees
- 3 RHIs of  $0^\circ$  to  $30^\circ$
- Duration of scanning mode **less than or equal to 3 minutes**

Météo-France Radial resolution less than or equal to 200 m

- Angular resolution less than or equal to  $1^\circ$





# Nice Doppler Lidar timeline

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- Call for tender : Q1 2018
  - Choice : Mitsubishi Série A DIABREZZA, 2<sup>nd</sup> generation
- Contract notification : April 2018
- Lidar installation : April 2019
- Tests, validation, pre-op : Q2-Q4 2019
- Operational : 2020



# From one airport to another

A satellite-style map of France and its surrounding regions, including parts of the UK, Ireland, and Italy. Two airports are highlighted with white airplane icons and text labels. The first is in the north-central part of France, and the second is on the southern coast. The map shows green landmasses, blue oceans, and brownish mountain ranges.

Clermont-Ferrand Auvergne (LFLC – CFE)



Nice Côte-d'Azur (LFMN - NCE)





# Clermont-Ferrand Auvergne (LFLC – CFE)

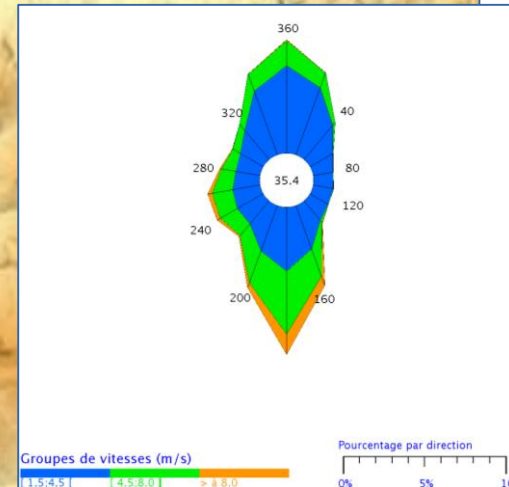
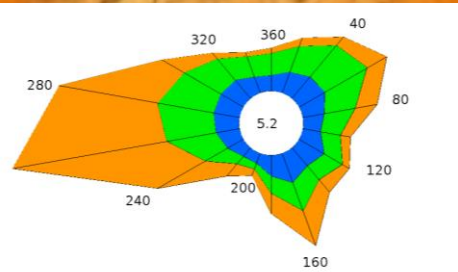
(400 k Pax/y 35 k Movements/y)

Clermont-Ferrand Auvergne airport  
(332 m ASL)

Puy de Dôme  
(1465 m ASL)

Puy de Crouel  
(429 m ASL)

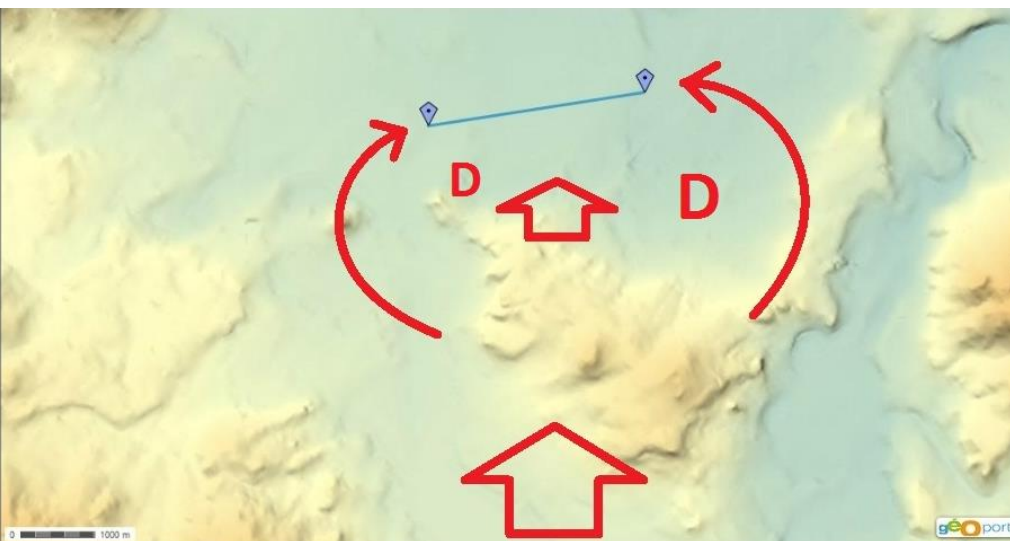
Puy d'Anzelle (528 m ASL)  
Puy de Bane (542 m ASL)



# Process documentation (1) : local expertise

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- Windshear-favorable situation :
  - Synoptic wind directions between  $150^\circ$  and  $260^\circ$
  - Gust speed above 15 m/s (29 kt)
- Often occurring before a front
- Windshear layer thicker in case of synoptic perturbation



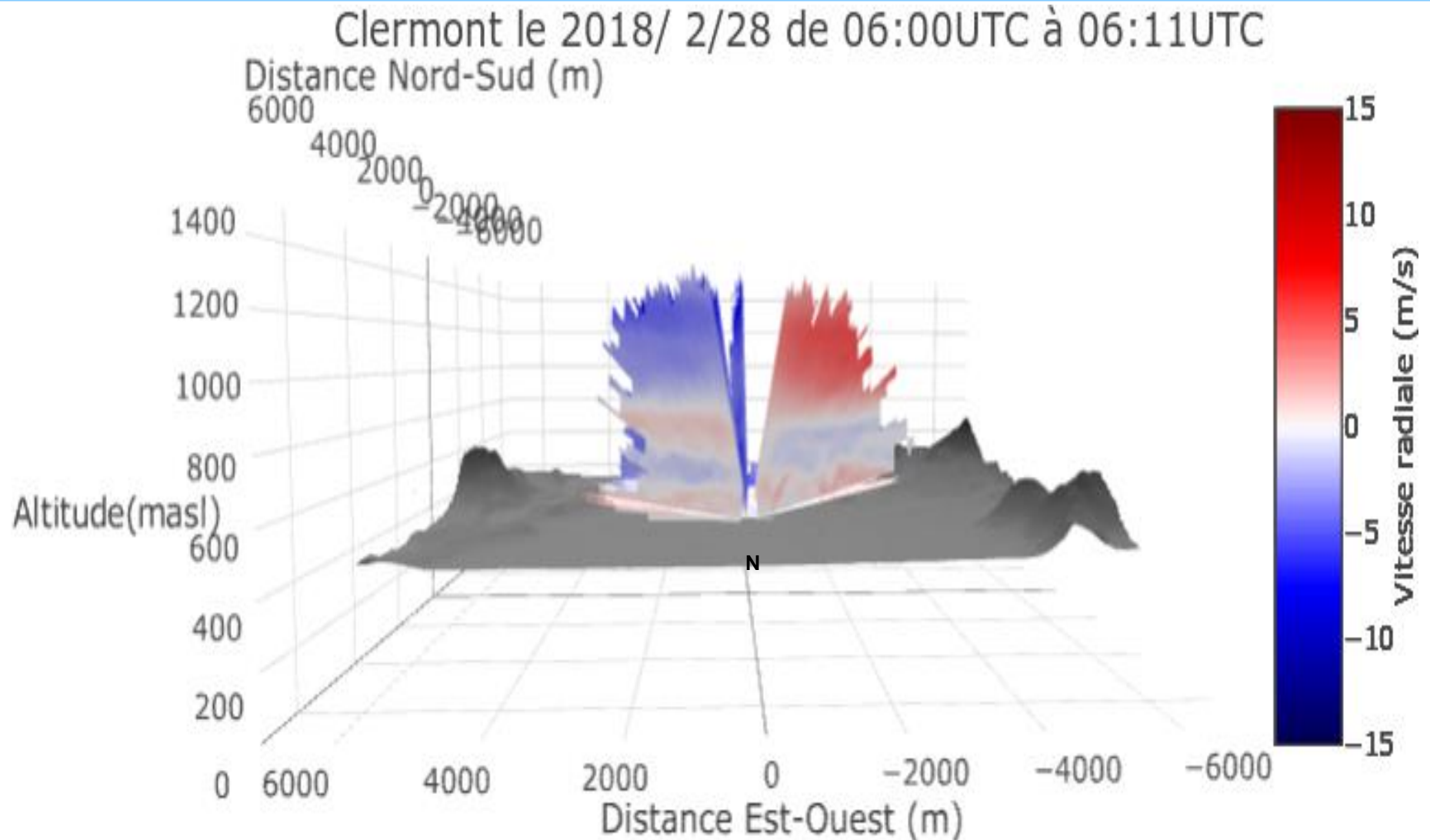


# Process documentation (2) :

## Field campaign

<p>UHF wind profiler (DH PCL 1300)</p>		<p>2017-01 onwards</p>
<p>Doppler Lidars (Leosphere WLS200)</p>		<p>2017-10 → 2018-04</p>
<p>MW radiometer (RPG HATPRO)</p>		<p>2017-10 → 2018-04</p>
<p>Additional station</p>		<p>2017-10 → 2018-04</p>

# Process documentation (3) : Field campaign







DEGREANE HORIZON

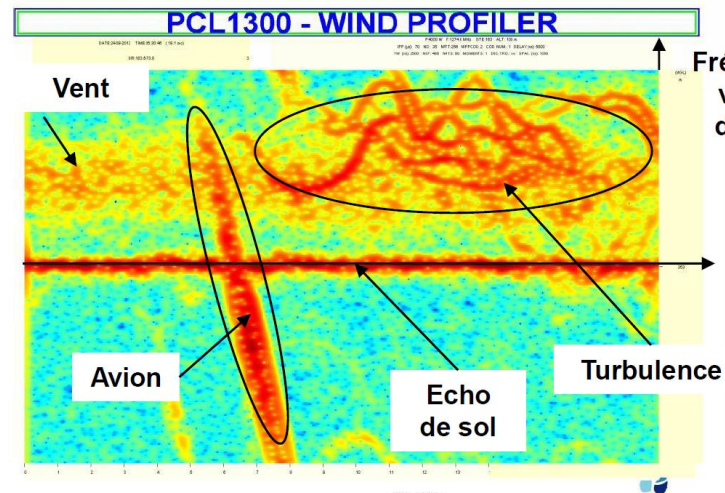
# Technological Test-bed

## An UHF Doppler Radar to measure wind along aircraft approach path ?

- Antenna Technology

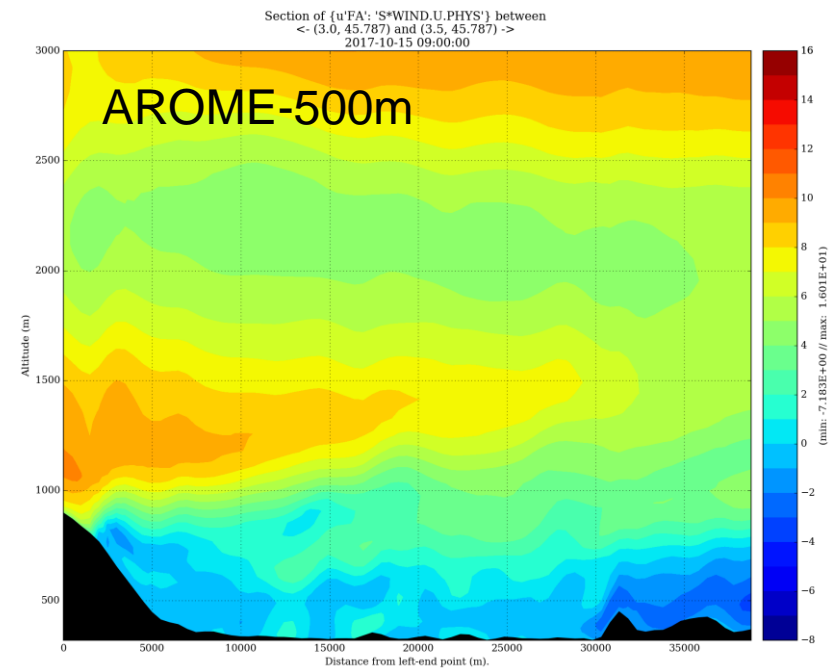
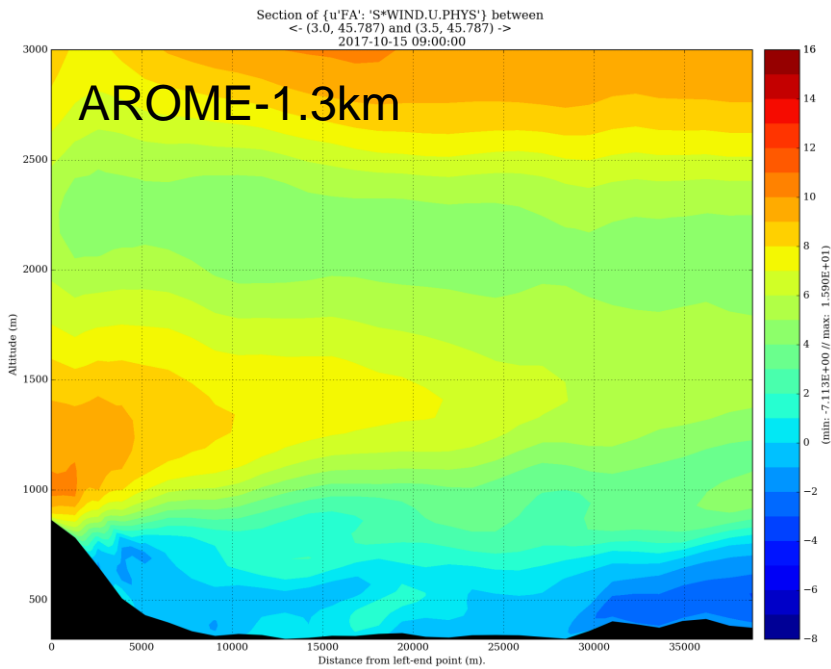


- Signal Processing



# Testing Forecast Capacity

- Impact of model resolution
- Necessary observations : UHF profiler, ADD (“Mode-S”), else ?







**Have a safe flight !**

**Météo-France**

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