DELICAT

The meteorological part in the European project DELICAT
DEmonstation of LIdar based Clear Air Turbulence

The DELICAT project aims to validate an advanced and new technology for medium-range detection of Clear Air Turbulence. It will allow the improvement in the understanding of CAT phenomenon and the forecasting capabilities.

The project

•T0: April 2009, duration 3,5 years

•Project total cost 5.6M€, European Commission contribution 3.8M€

•12 partners:

1. Thales — THALES
2. CNRS — cnrs
3. DLR — DLR
4. Hovemere — HOVEMERE LTD.
5. Météo France — METEO FRANCE
7. NLR — NLR
8. ONERA — ONERA
9. INOE — inoe 2000
10. Institute of Atmospheric Physics - IAP — IAPA
11. Laser Diagnostic Instruments — LASER DIAGNOSTIC INSTRUMENTS
12. Warsaw University – ICM
13. EADS-IW — EADS

•Flight test campaign

NLR Cessna Citation research aircraft with fairing

The experiment

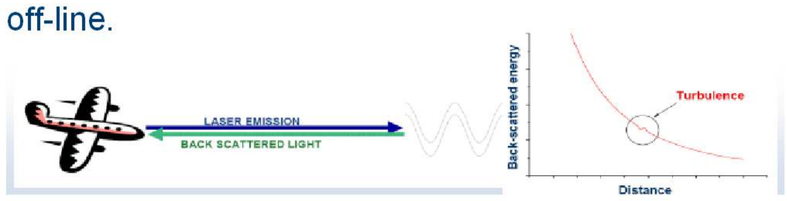
•Vertical wind speed can be detected through air density fluctuations => fluctuations of LIDAR backscattered energy (Rayleigh contribution, molecular back-scattering).

•A LIDAR prototype has been developed and is placed in the NLR research aircraft.

•The atmosphere on flight path is analysed by the UV LIDAR (both molecular and aerosol backscatter signal recorded).

•The atmosphere on the flight path is analysed by the aircraft onboard sensors (accelerations and rotations, air temperature, airspeed, etc…).

•The data from the LIDAR and from the aircraft are compared off-line.

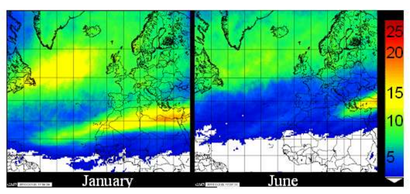


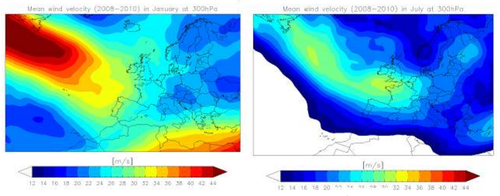
The meteorological part

Climatologies

•Based on the ERAinterim reanalysis from the ECMWF (20 years) Ellrod index on Europe

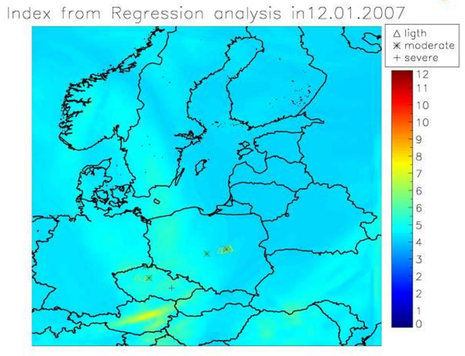
•Based on the COAMPS model- Coupled Ocean/Atmosphere Mesoscale Prediction System- resolution ~ 39km, period : 2008-2010, at least 4 forecasts every 3h.





January *June*

Indices calculated by adaptative method



Example of regression calculated vertical gust, based Ellrod1, Colson-Panofsky and Vertical Wind Shear indices, with some AMDAR observations

First method : Adaptative multidimensionnal regression analog to Sharman et al (2006) Result represents expected vertical gust speed.

Second method : machine learning method (random forest) using AMDAR turbulence indices and NWP models

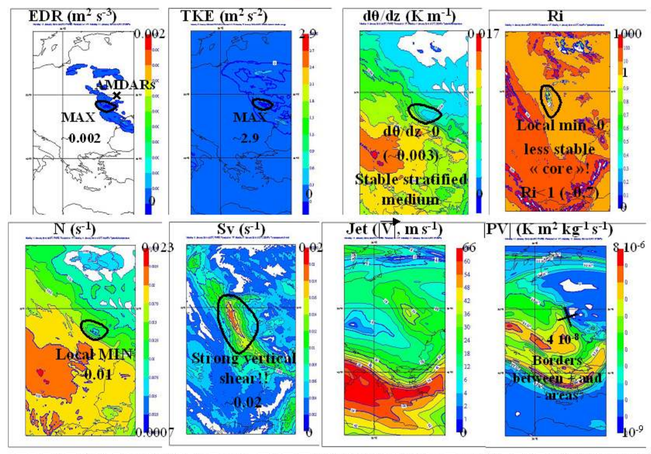
Third method : optimization of horizontal resolution (see Passner et al (2008))

Indices calculated at high vertical resolution

•A selection of CAT indices are calculated on the Météo-France NWP model at high resolution (horizontal ~10km, vertical ~10m), 24h forecasts every 6h. Data set : Jan-May 2010.

•Verification will be performed by using AMDAR data DEVG and turbulence indices

•Study case : 11th of January 2010 at 01UTC at 275 hPa ~ 10km



EDR: Eddy Dissipation Rate, TKE:Turbulent Kinetic Energy, Ri:Richardson number, N: Brunt Vaisala fequency, Sv: Vertical wind Shear, PV: Potential Vorticity

Flight test campaign : October & December 2011

•A specific meteorological assistance will be provided during the campaign

Validation

•The data collected during the flight test will be used as a validation data base to verify the indices developed during the project.

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The research leading to these results has received funding from European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 233801

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Toujours un temps d'avance