NEURAL NETWORK TECHNIQUES FOR NOWCASTING OF FOG AT GUARULHOS AIRPORT

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Outlines

- INTRODUCTION
- STUDY AREA
- DATA
- METHOD
- RESULTS
- FINAL COMMENTS

INTRODUCTION

- The takeoff and landing are the most dangerous phase of a flight;
- The weather condition is a critical factor for the aircraft controller takes any action;
- Statistically higher occurrence of the phenomenon to the restricted visibility is fog, over 90% (*Almeida, 2009*);
- Numerical weather prediction models can not be able to produce confident performance for nowcasting period.

INTRODUCTION

➢The present work mainly aims to train, test and validate *three different approaching* for fog nowcasting. This methods are as follows:

- Multiple Linear Regression (MLR);
- Probabilistic Neural Network (PNN);
- Generalized Regression Neural Networks (GRNN).

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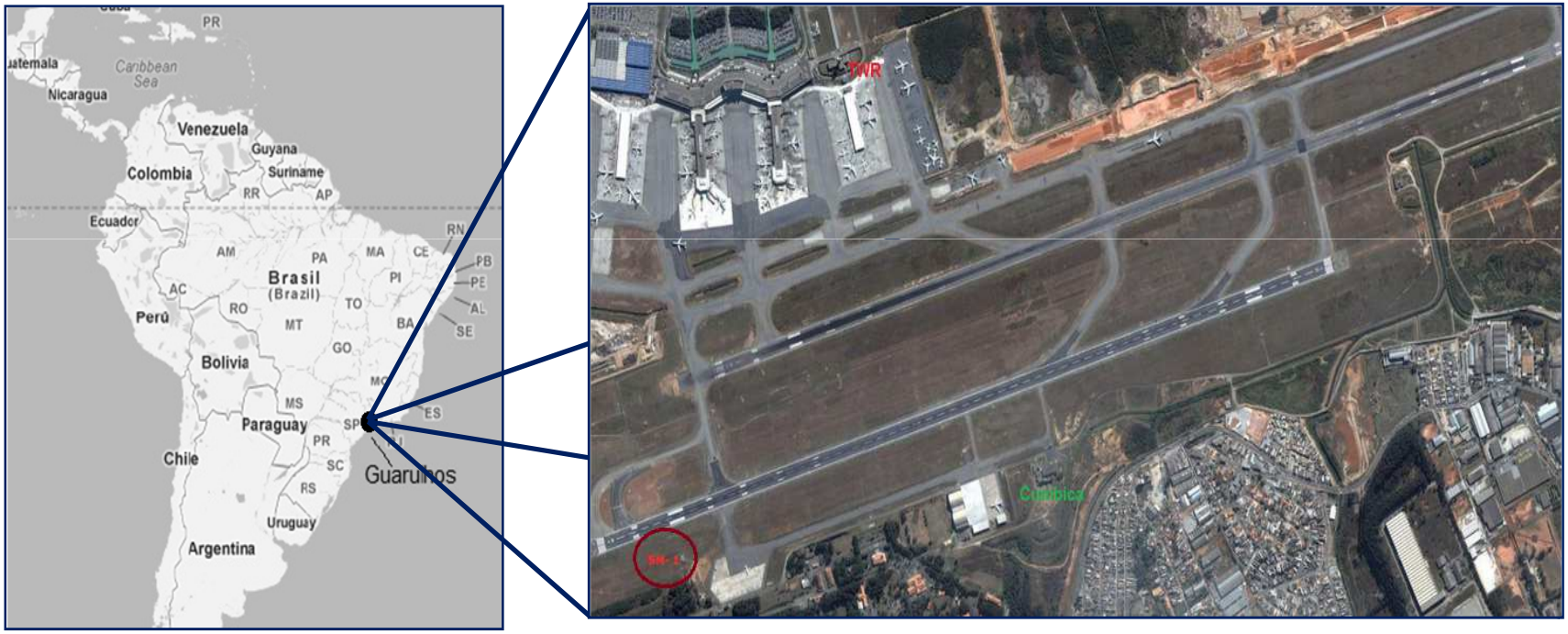
STUDY AREA

Guarulhos International Airport



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DATA

- Hourly meteorological observations from Meteorological Station of Guarulhos (SBGR);
- Period: 1st of January, 1951 to 31st of March, 2007;
- Number of Observations: *450,243 .*

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METHOD

1. *Temperature;*
2. *Humidity;*
3. *Pressure;*
4. *Wind;*
5. *Julian day;*
6. *6 hours of sky clear;*
7. *Clouds cover;*
8. *Weather condition;*

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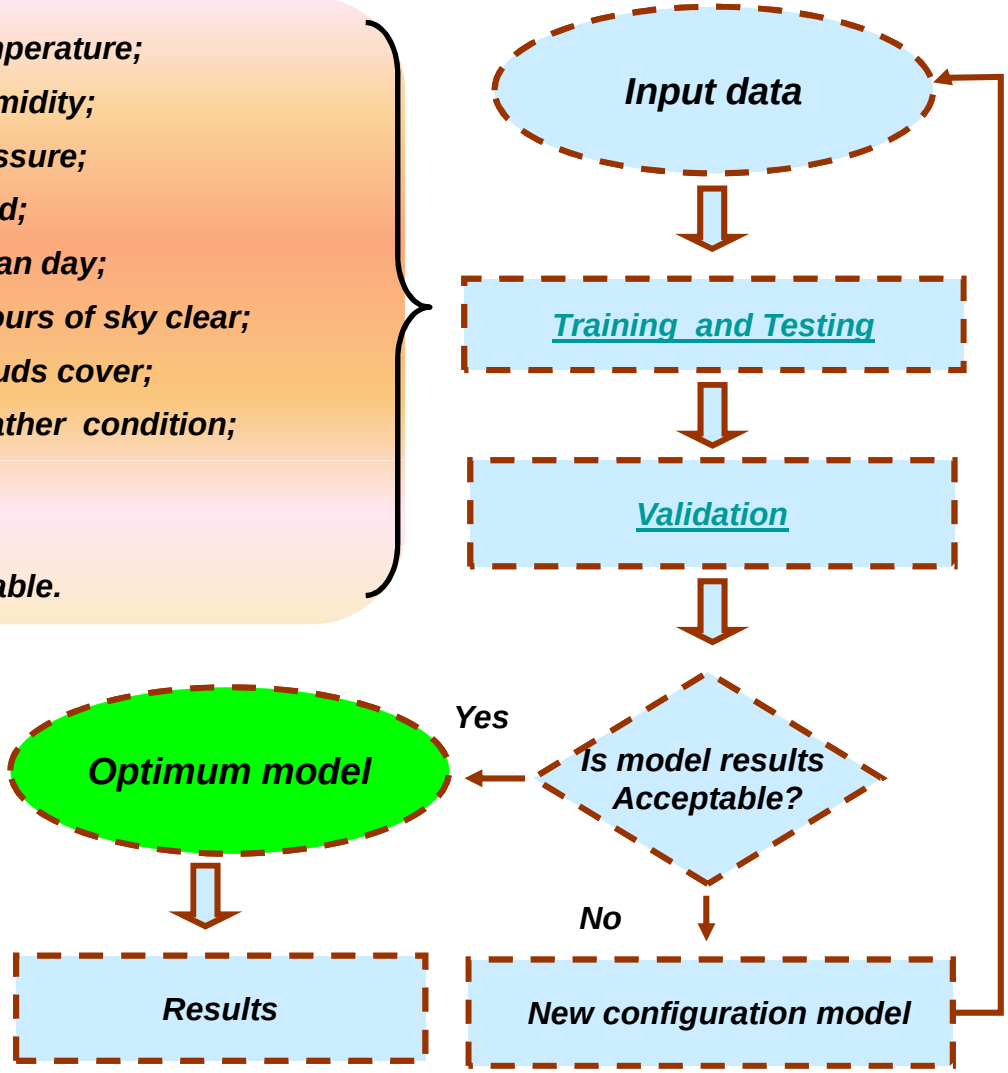
27th variable.



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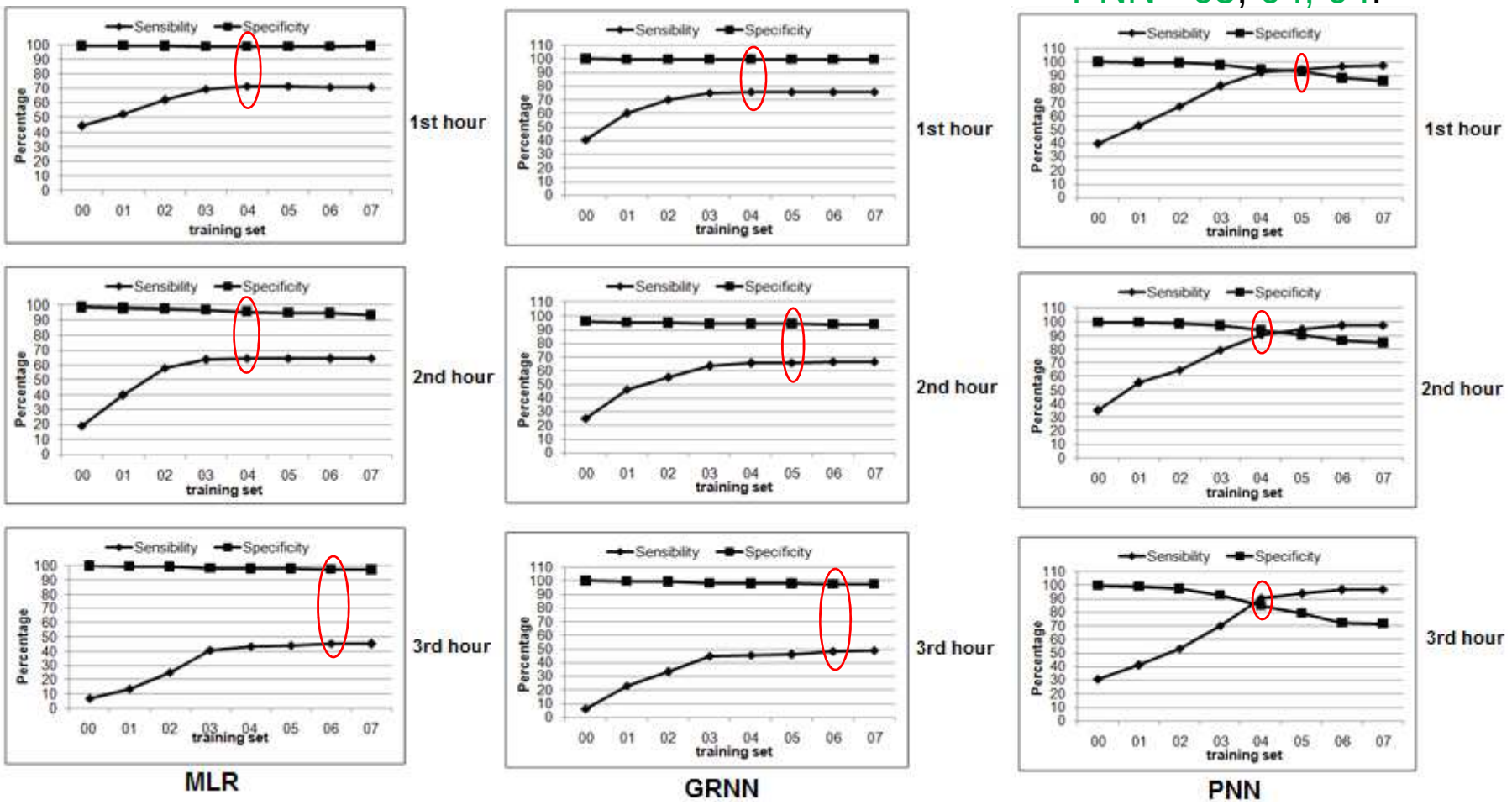
RESULTS

Training sets ⇒best results (for 1ª, 2ª and 3ª hour):

MLR - 04, 04, 06. GRNN - 04, 05, 06. PNN - 05, 04, 04.



RESULTS

Hour	Approach	Dataset	Sensitivity(%)	Specificity (%)
1st	MLR	04	70	99
	GRNN	04	75	97
	PNN	05	95	93
2nd	MLR	04	64	95
	GRNN	05	69	95
	PNN	04	91	94
3rd	MLR	06	46	96
	GRNN	06	49	97
	PNN	04	89	83

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FINAL COMMENTS

Since 2009, the Probabilistic Neural Network (PNN) is presently using for fog nowcasting as part of a nowcasting system at Guarulhos International Airport.

Site - *http://www.redemet.aer.mil.br/rna_saida.php*

FURTHER RESULTS

Thunderstorms Nowcasting for Rio de Janeiro Region

Nowcasting	Sensitivity (%)	Specificity (%)
1st hour	90	85
2nd hour	88	86
3rd hour	88	81

FURTHER RESULTS

Thunderstorms Nowcasting for Guarulhos region

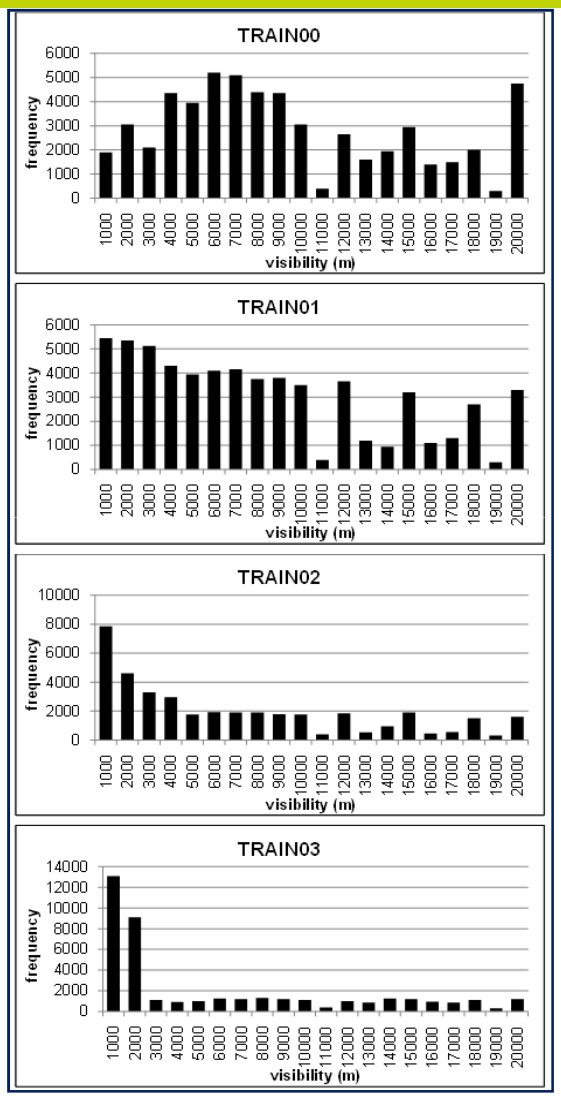
	1st hour	2nd hour	3rd hour
Sensitivity (%)	89	90	95
Specificity (%)	88	75	70

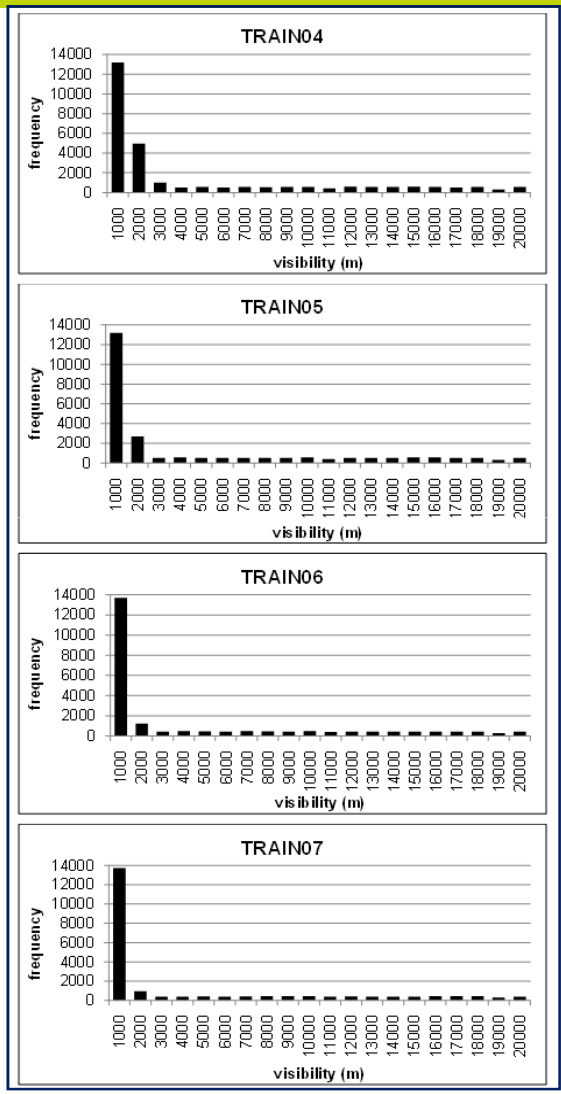
Questions?

METHODS

In order to train the networks (PNN and GRNN), eight training sets were created.

These datasets were slightly modified by increasing proportionally the number of FOG and low visibilities events





Validation Criterion

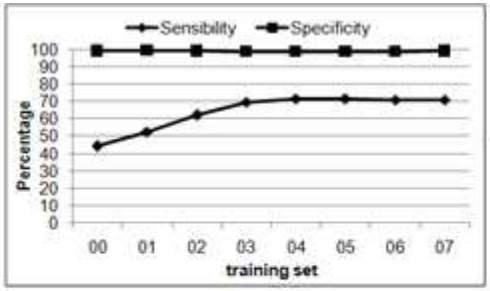
It is based on the sensitivity and specificity statistics.

Sensitivity is the ability of the model to correctly classify the desired event or *the percentage of true-positive*;

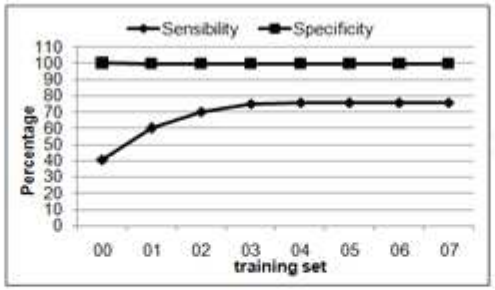
Specificity is the ability of the model to correctly classify the non-event or *the percentage of true-negative* (Wilks, 2006)

Sensitivity	Specificity	Performance
high	high	optimum
high	low	overestimated
low	high	underestimated
low	low	bad

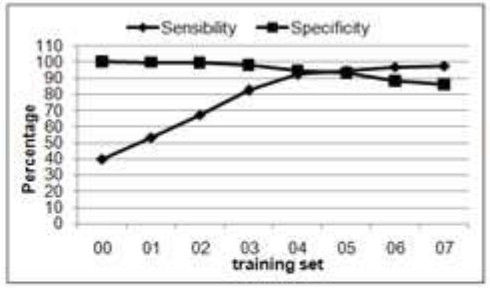
VALIDATION



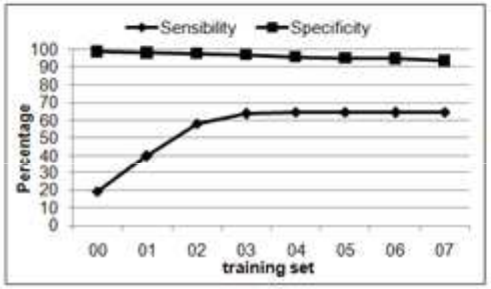
1st hour



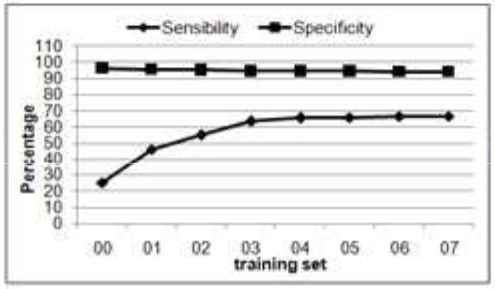
1st hour



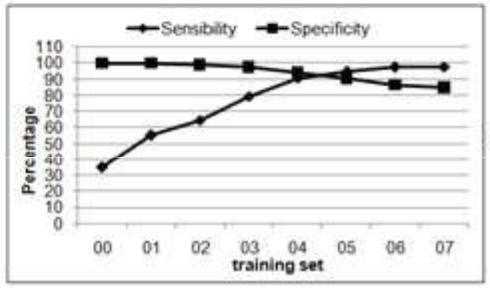
1st hour



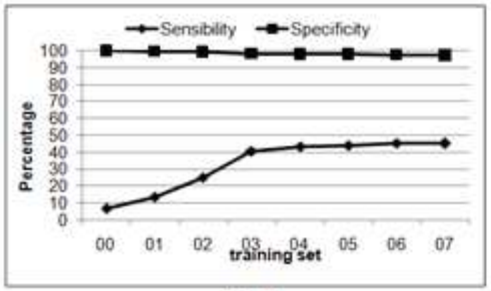
2nd hour



2nd hour

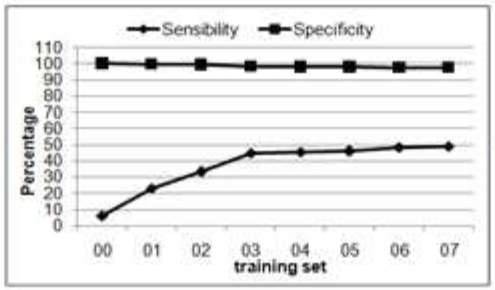


2nd hour



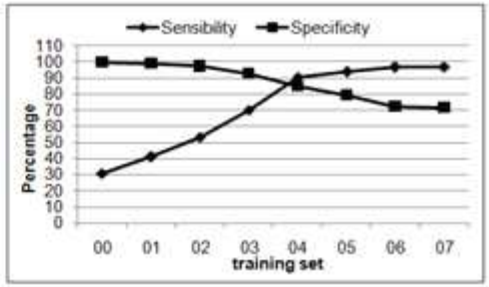
3rd hour

MLR



3rd hour

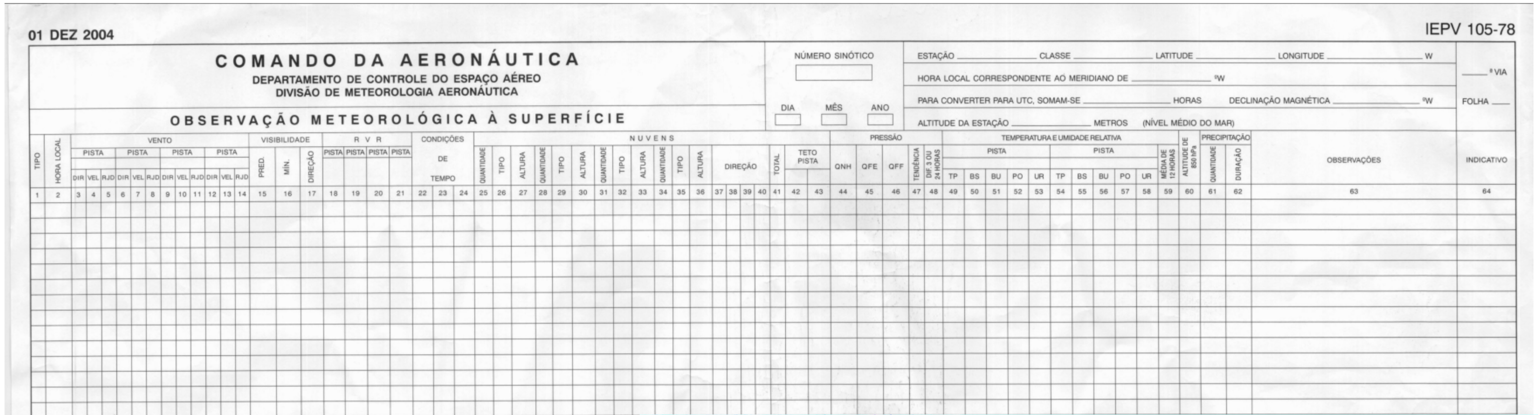
GRNN



3rd hour

PNN

UFRJ



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COMANDO DA AERONÁUTICA

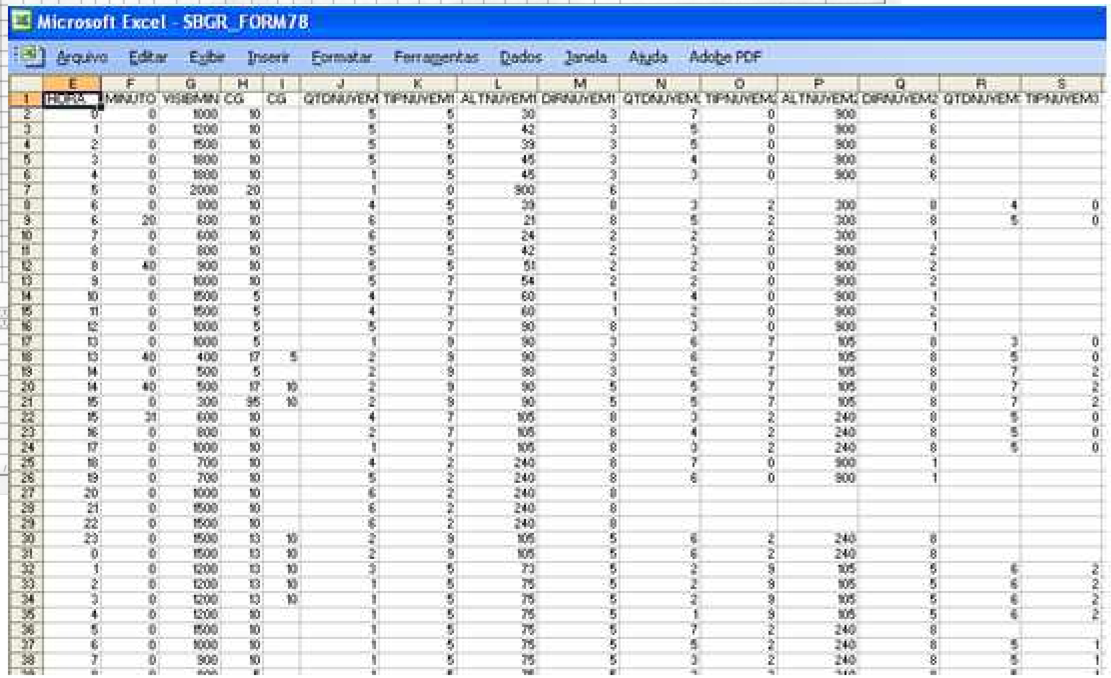
DEPARTAMENTO DE CONTROLE DO ESPAÇO AÉREO

DIVISÃO DE METEOROLOGIA AERONÁUTICA

OBSERVAÇÃO METEOROLÓGICA À SUPERFÍCIE

OBSERVAÇÕES SINÓTICAS CODIFICADAS

VERIFICADO POR: EM / / CORRIGIDO POR: EM /



Microsoft Excel - SBGR_FORM78

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