ASSESSING ATMOSPHERIC ASSIMILATIVE CAPACITY TO AIR POLLUTANTS EMITTED FROM COAL POWER PLANTS IN THE SOUTH OF BRAZIL: USING CALPUFF AS A DECISION SUPPORT TOOL IN THE ENVIRONMENTAL PERMITTING PROCESS

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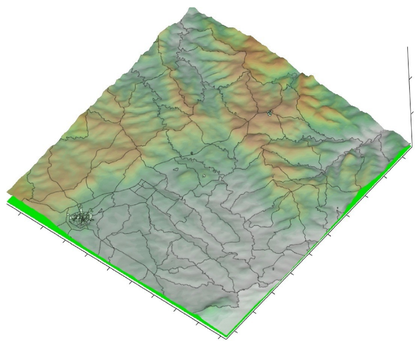
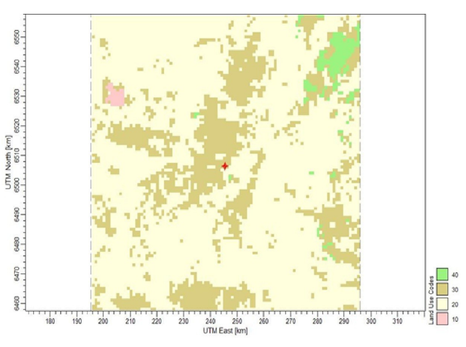
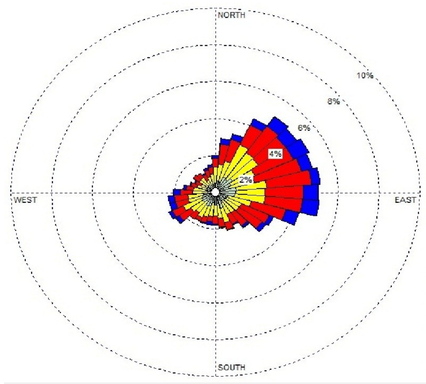
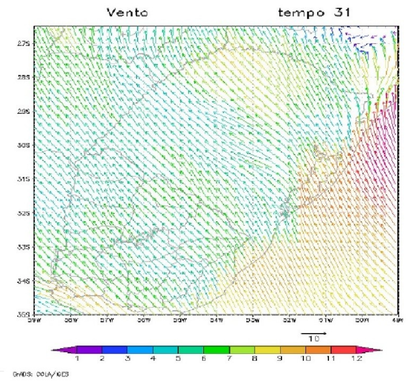
ABSTRACT
The Brazilian law establishes that the federal environmental agency (IBAMA) it's responsible for the permitting process of thermal power plants (TPP) with nominal power over 300 MW. In far south of Brazil, close to the Uruguayan border, the coal deposit of Candiota has been exploited for power generation since 1970. Nowadays a 796 MW nominal capacity complex it's under operation with older and newly units; a 350 MW new complex it's under construction; and others 2,477 MW TPP projects are in different phases of planing. Concerned to develop prevent deterioration indexes and to avoid transboundary pollution, IBAMA, EPE and UFRGS developed an atmospheric dispersion modeling study using CALPUFF coupled with 2011 to 2015 WRF and local meteorological and air quality monitoring data to assess assimilative capacity to SO_2, PM and NOx air pollutants from currently and new projects. Conclusions revealed that in function of industrial park modernization, the future scenario exerts less pollution saturation of the aerial basin, even with increasingly power generation and more spatial distribution of sources, orienting the environmental permitting processes of planed TPP. Further work also evaluated the urban population exposure using the Intake Fraction (IF). An Environmental Pressure Index (EPI) were developed to evaluate grades of regulatory standard saturation. Well known recommended statistical tests were applied, indicating satisfactory model performance

MODELLING OVERVIEW





WRF Data
115x115 grid cells
10 km grid cell resolution
28 vertical levels
60s temporal resolution

MET STATIONS
INMET Sta. (6 regional)
CGTEE Sta. (1 local)

DEM
SRTM3
90M resolution

AERIAL IMAGE
Topography check
Building 3d Model

LAND COVER
MMA Probio
(Landsat 5 TM and 7 ETM+)
GLCC
(AVHRR 1,0 x 1,0 km resolution)

CANDIOTA AERIAL BASIN STUDY → **CALMET** → **CALPUFF** → **CALPOST**

CONCENTRATION ISOLINES
SO2, PM, NO2

HOURLY MEAN
a. NO2 Regul. Stnd. Check

DAILY MEAN
a. SO2, PM Regul. Stnd. Check
b. Model Test Performance

ANNUAL MEAN
a. SO2, PM, NO2 Regul. Stnd. Check
b. Intake Fraction Estimates
c. Environmental Pressure Index Estimates

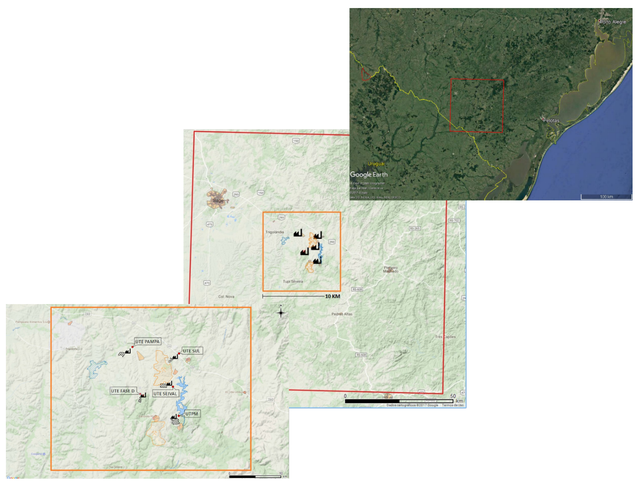
MONITORING STATIONS
AIR QUALITY
MET DATA
CEMS

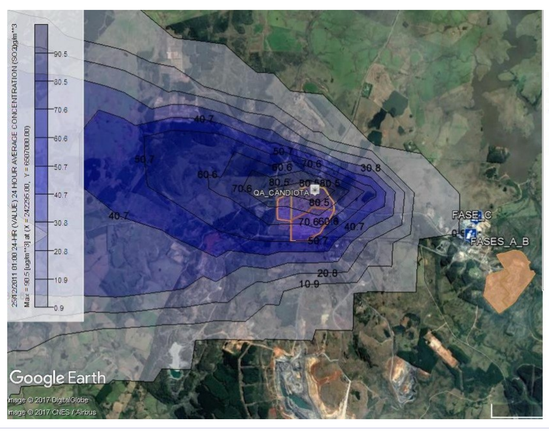
COMPUTATIONAL GRID
100 x 100 km grid
1,0 x 1,0 km grid cells

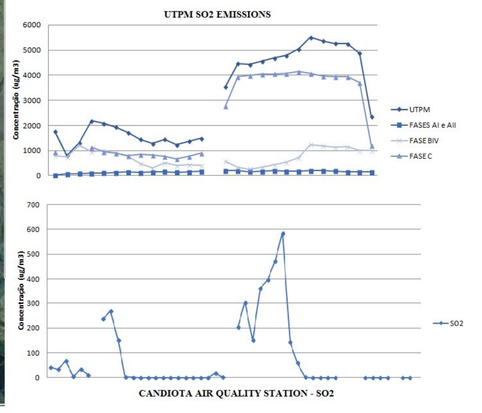
SETUP DEFAULT OPTIONS
+ Total NOx to NO2
+ Building Downwash

FUTURE SCENARIO
11 TPPs (3,581 MW)
SO2: 2,707.9 g/s
PM: 383.7 g/s
NOx: 1,823.9 g/s

CURRENT SCENARIO
5 TPPs (796 MW)
SO2: 3,266.1 g/s
PM: 696.03 g/s
NOX: 375.9 g/s

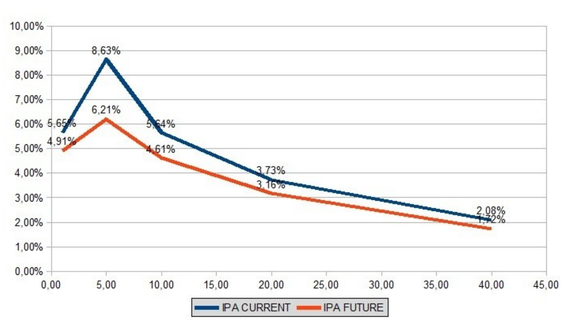


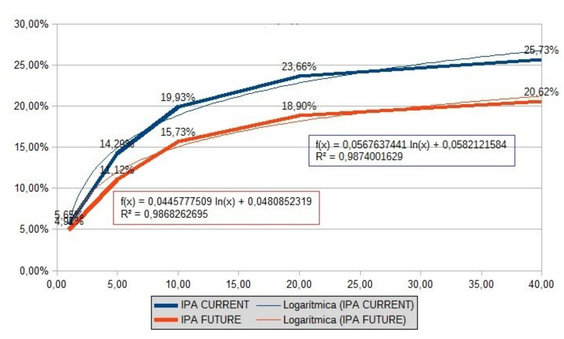




CONCLUSIONS

The UTPM complex exerts high influence in the 5,0km SO_2 and PM saturation zone, even with complex adaptability evaluated in the future scenario. Another important factor is that new TPP planned are at distances about 5,0, 10,0 and 15 km from the center of the grid and besides their sources configuration that promotes better plume elevation favoring dispersion, alongside lower emission rates, it's upstream location influences the center of the grid as predominant wind directions are from north and northeast. That is also observed by the lower relative difference values between 5,0,0 to 20,0 km radius. Otherwise, NO_2 relative differences between 10.0 and 40.0 km radius are more constant, thus representing long range influence of new TPPs due to higher NOx emission rates. It's also true that future UTPM configuration contributes both for long range and for the 5,0 km saturation zone, observing the lower relative difference at that radius. Comparing the calculated IF with results presented by Zhou et al., 2003, we can conclude that either the low population density and reduced covered area studied were significant variables for lower results. Environmental permitting processes and analysis are now oriented by this assimilative capacity study supporting institutional decision for planned coal TPP in Candiota/RS region.





AERIAL BASIN SATURATION – ENVIRONMENTAL PRESSURE INDEX COMPARISSON BETWEEN SCENARIOS