UFRJ Universidade Federal do Rio de Janeiro
CCMN Centro de Ciências Matemáticas e da Natureza
IGEO Instituto de Geociências - Departamento de Meteorologia
LAMMA Laboratório de Modelagem de Processos Marinhos e Atmosféricos
NCQAr Núcleo Computacional de Qualidade do Ar

# Air Quality Photochemical Simulations using the system MM5 – SMOKE – CMAQ for Brazil

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- The CMAQ model has been implemented to Brazil, with focus to the Amazonia area;
- Feeding emissions data into South America and its surroundings has been our biggest challenge;
- The changes in Landuse, the intense economic growth linked to the need for preservation make the environmental management a complex task for Brazilian Amazonia area.

# Methods

- The system is driven with MM5 met runs, global emissions data feeded into smoke model, MEGAN model for biogenics and CMAQ for air quality forecast;

- Composed with an external grid that cover almost all south american countries, horizontal resolution of 37 km, and 32 vertical levels (8 in PBL);

- No GCM model data are adjusted to these initial runs.

# Methods main area

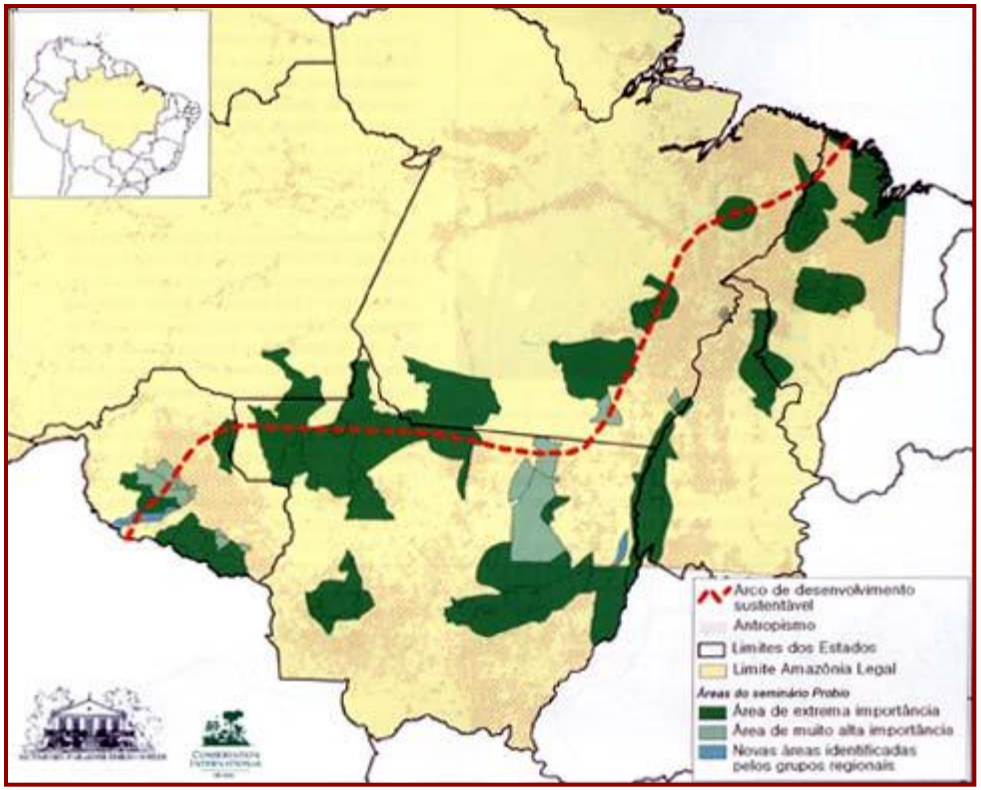



**Figure 1** Arch of deforesting
Arch of sustainable development

**Table 1** – MM5 Parameterizations.

| | |
|---|---|
| **Cumulus** | Grell (1993) domain 1 and 2[1] |
| **Clouds Microphysics** | Dudhia (1989) |
| **Radiation** | Dudhia (1989) |
| **Landuse** | Landuse model NOAH LSM (Chen e Dudhia, 2001) |
| **PBL** | Mellor e Yamada (1974, 1982) |

1. Not applied for horizontal resolutions under 10 km

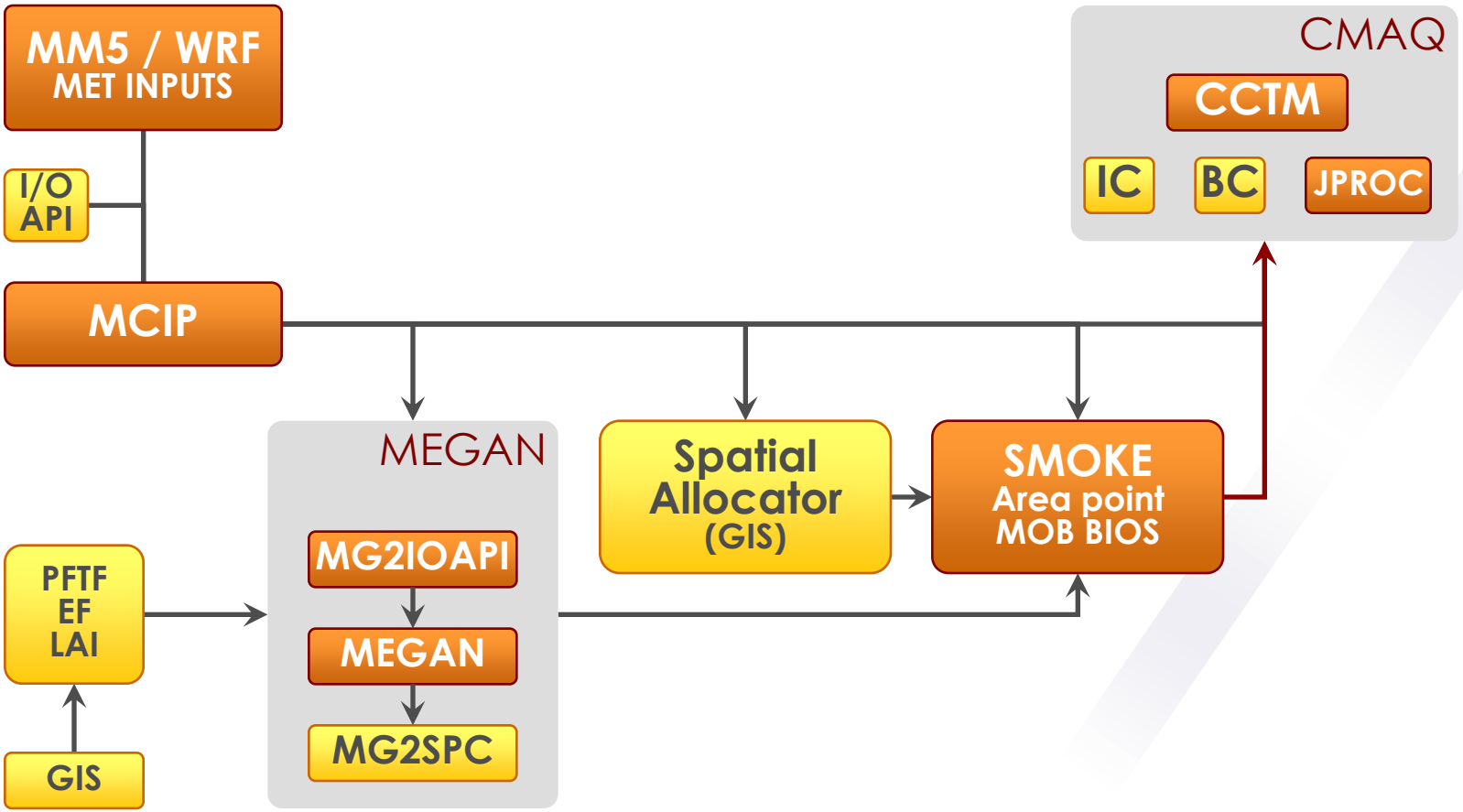
# SMOKE

- Process emission data from the inventory format into the one required by CMAQ;
- Feeded with global emission inventories data (www.geiacenter.org);
- GEFED 1° x 1° (Biomass burning); IBGE (Main National Roads then em fact from GIS tools); Shipping Emissions (from GIS tool) and some global emissions (also GIS) for the surrounding countries;
- MEGAN model for the Biogenics.

# CMAQ

- CCTM solve the ADE;
- In our case the chemical mechanism used is CB05 (not the objective to set up one at this moment);
- Resolution of 37 km for the coarse domain;
- Run for August 2005, intense dry season in Amazonia.

# Scheme


MM5 / WRF
MET INPUTS
I/O API
MCIP
CMAQ
CCTM
IC
BC
JPROC
MEGAN
MG2IOAPI
MEGAN
MG2SPC
PFTF
EF
LAI
GIS
Spatial Allocator
(GIS)
SMOKE
Area point
MOB BIOS

# Some Results emissions

from MEGAN

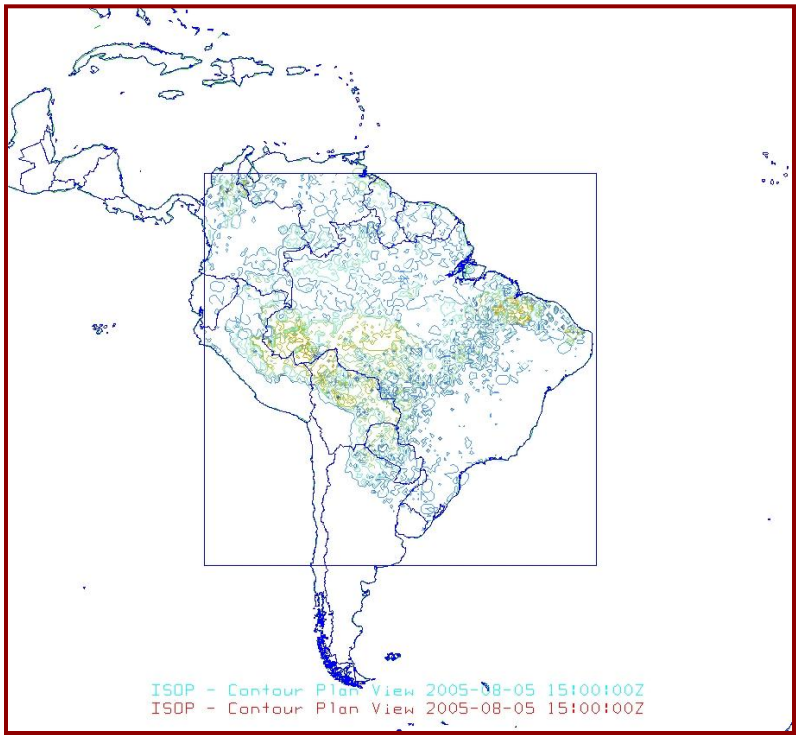



**Figure 2** | Ozone emissions for 1600 LT

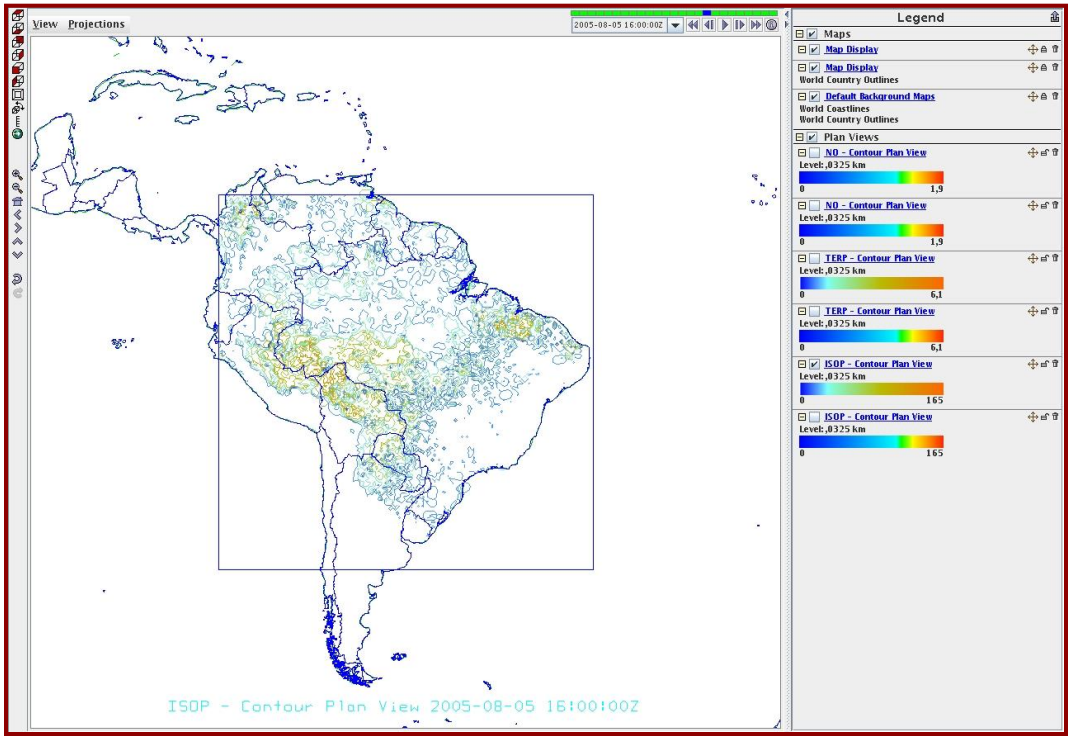



**Figure 3** | Ozone emissions for 1700 LT

# Some Results

from CMAQ

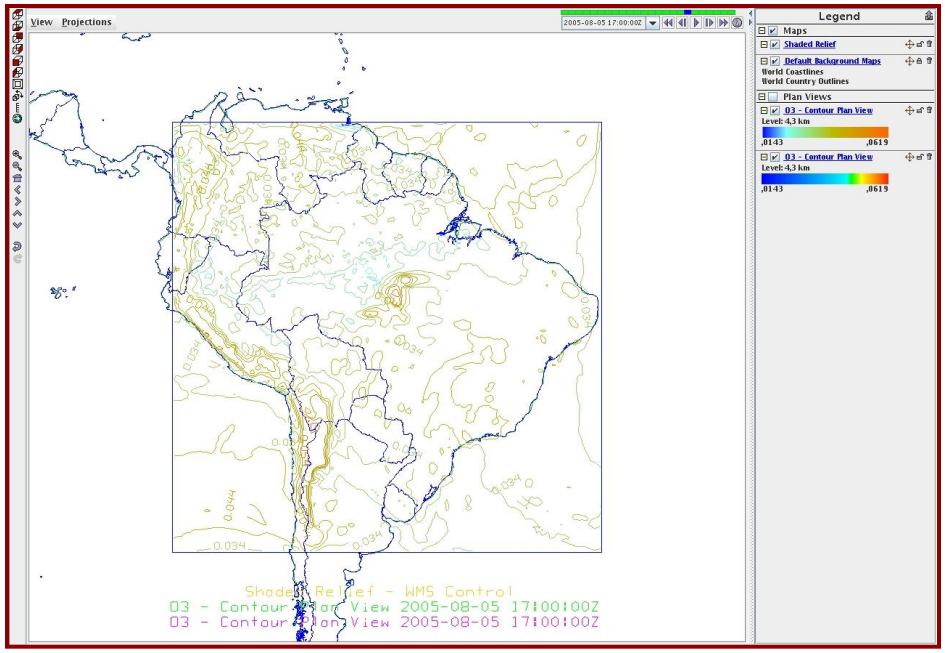



**Figure 4** | Ozone forecast for 1700 LT

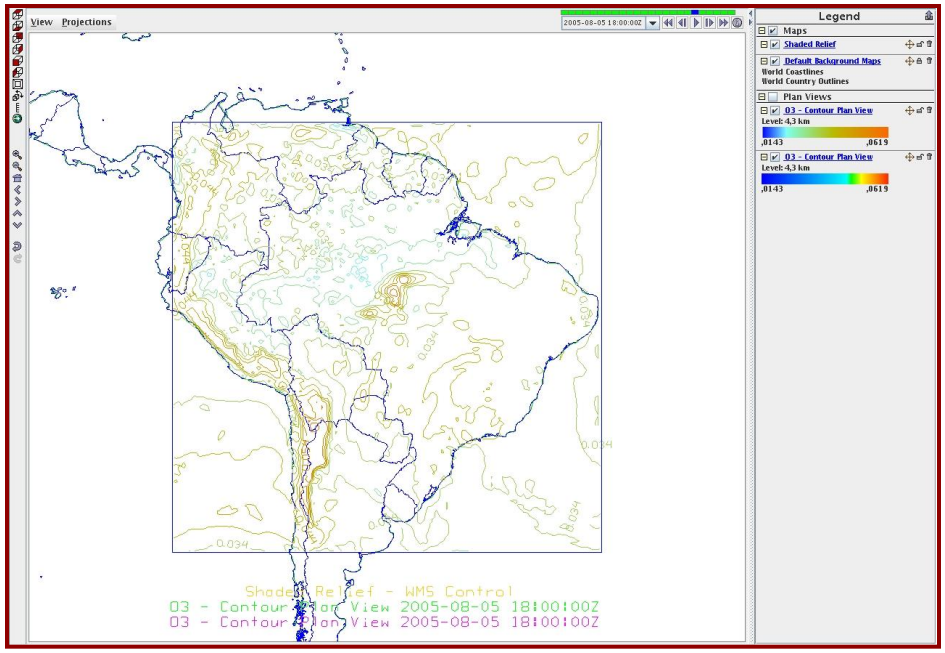



**Figure 5** | Ozone forecast for 1800 LT

# Some Results

from CMAQ

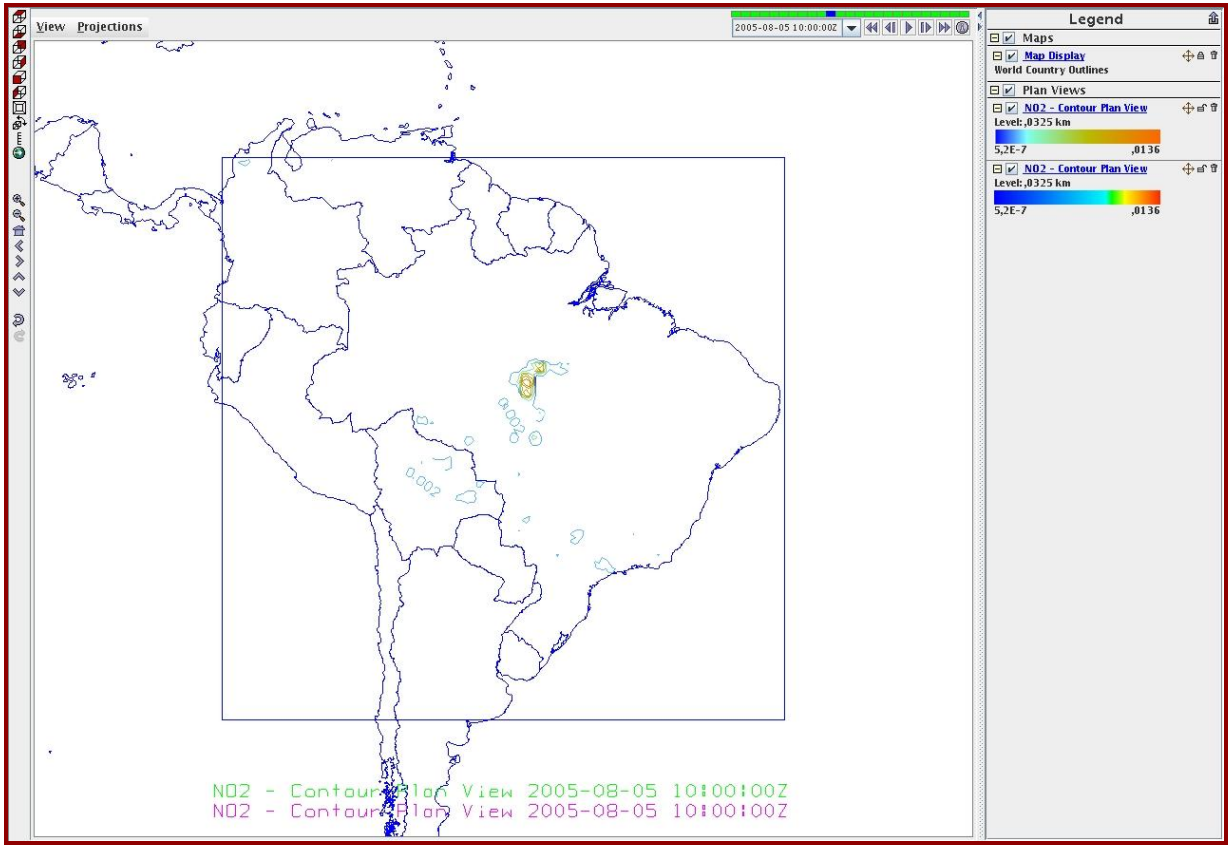
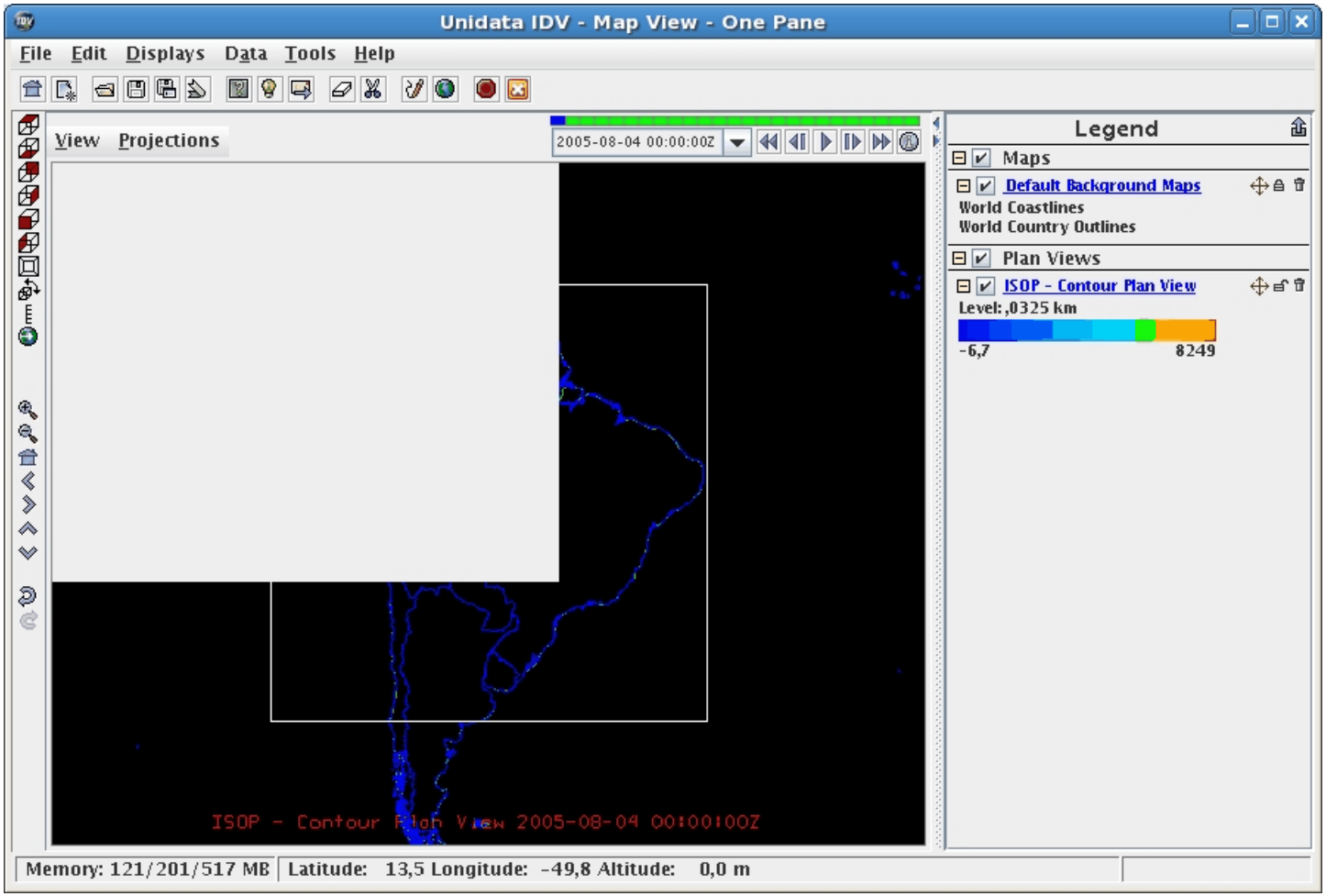



**Figure 6** | NO forecast for 1000 LT

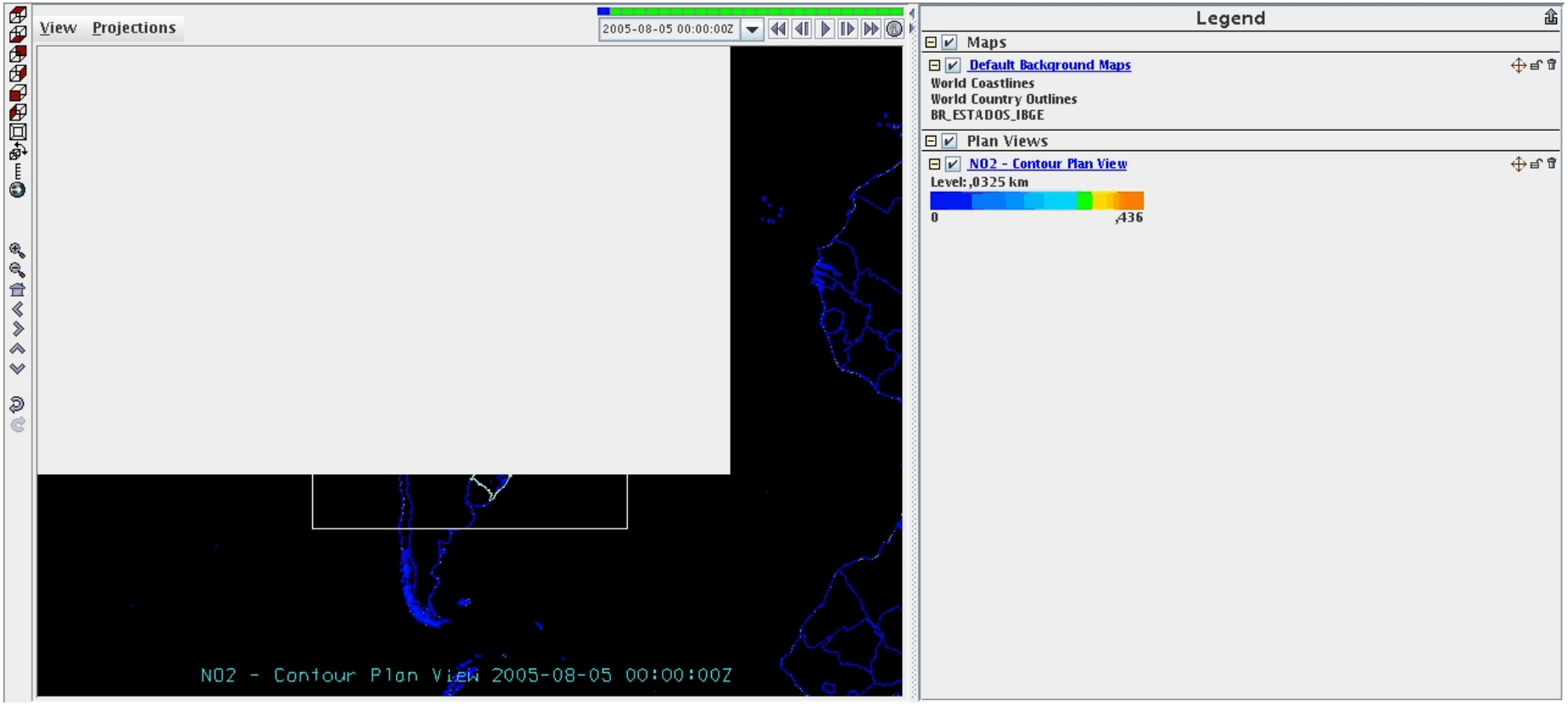
# Isoprene Emissions aug 3rd




Animation 1

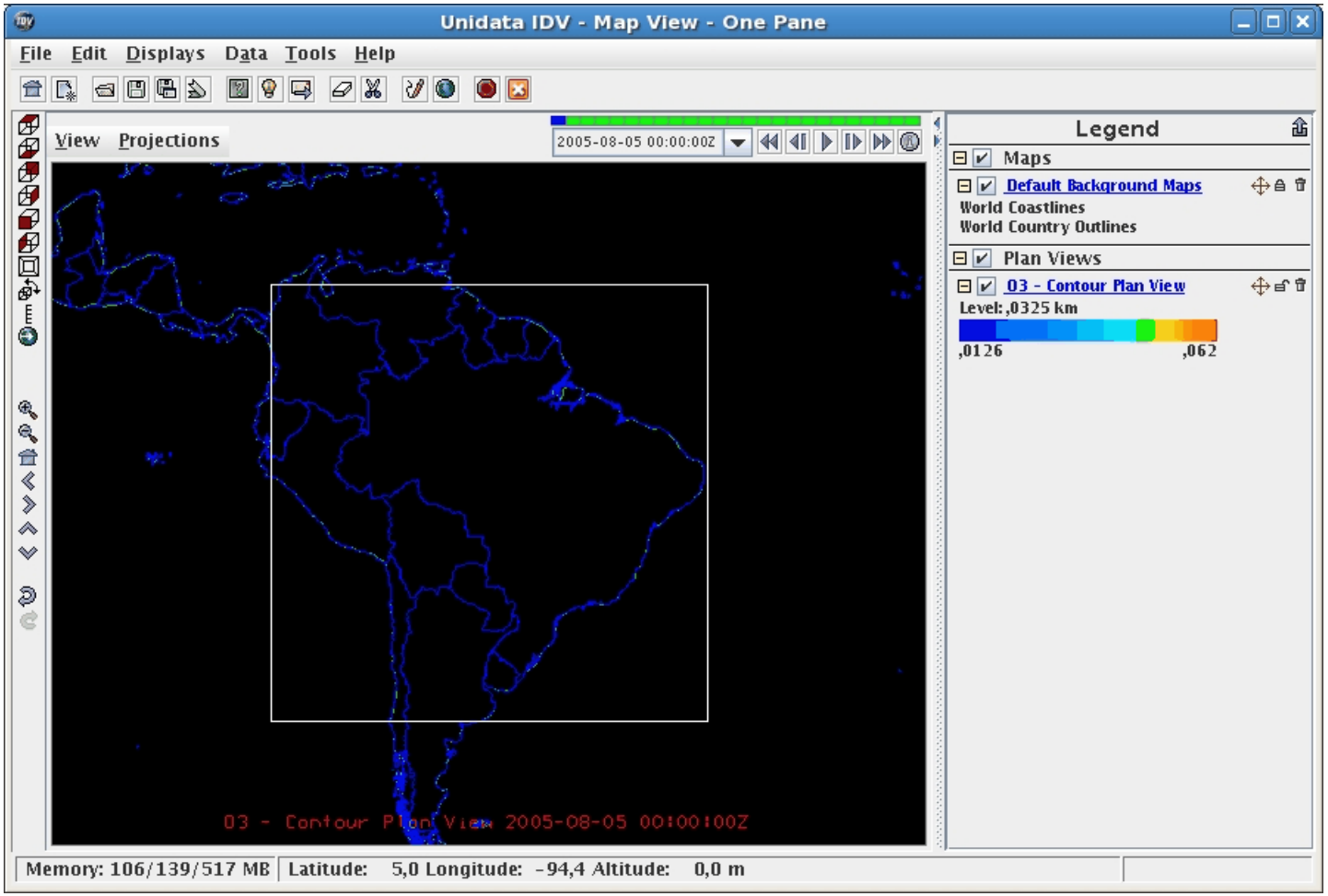
IDV ISO 217

# $NO_2$ Emission (anthropogenic)




Animation 2 | IDV $NO_2$ 217

# Ozone Outputs aug 3rd




Animation 2

IDV Ozone 217

# Some Conclusions

- The system is implemented to Brazil part of South America;
- Results shows that this procedure (emission data from global to regional) might be considered as an alternative for those without NEI;
- MEGAN is the best choice for Biogenics;
- CMAQ represented Ozone Fields according to the theory, besisdes neglecting important emissions
- The System needs some improvements (projection, emiss, chem mechanism.

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