# EVALUATION OF FLEXPART SMOKE DISPERSION USING MISR PLUME HEIGHTS

**Conference Paper** · May 2014

CITATIONS
0

READS
55

**6 authors**, including:



Fragkiski-Ioanna Sofiou
National Observatory of Athens
**4** PUBLICATIONS **4** CITATIONS
SEE PROFILE



Stavros Solomos
National Observatory of Athens
**78** PUBLICATIONS **451** CITATIONS
SEE PROFILE

# EVALUATION OF FLEXPART SMOKE DISPERSION USING MISR PLUME HEIGHTS

**Sofiou F.I.[1,2], Solomos S. [1*], Amiridis V.[1], Herekakis T. [1], Argialas D. [2], Kontoes C. [1]**

[1]Institute for Astronomy, Astrophysics, Space Applications and Remote Sensing, National Observatory of Athens, Athens, GR-15236, Greece

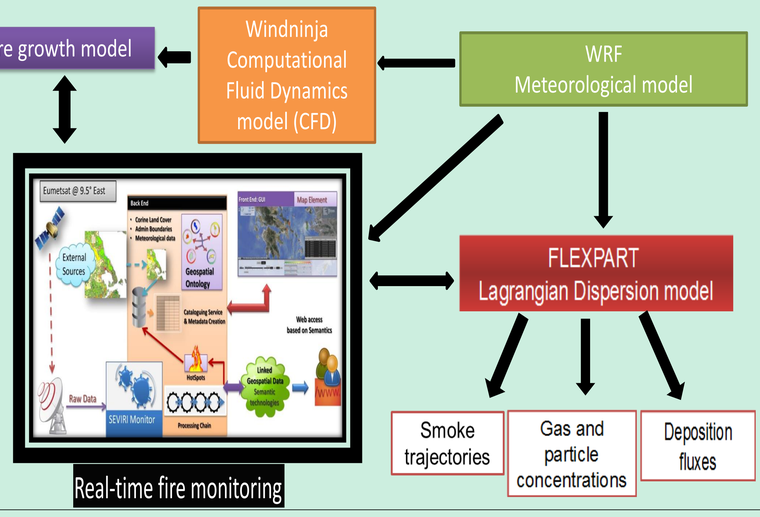
[2]National Technical University of Athens, School of Rural and Surveying Engineering, Laboratory of Remote Sensing, Heroon Polytechniou 9, 15780, Zografou, Greece

*stavros@noa.gr

## Introduction

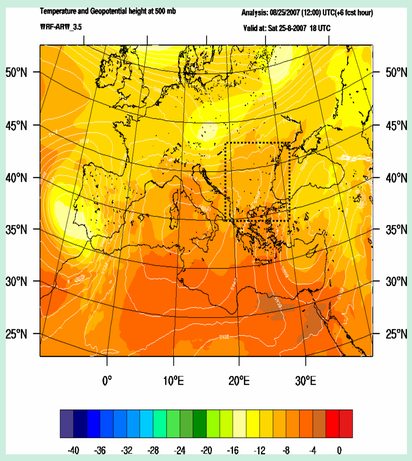
Biomass burning and ignition of wildfires are both related to climate change considerations. An increase in global temperature is expected to increase the frequency of occurrence for wild fires (Schar et al., 2004). Emitted biomass particles are in turn assumed to be major climate regulators (IPCC 2013) playing a significant role in radiative transfer in the atmosphere and also in cloud processes. In the present study a joint modeling and remote sensing method is presented for the description of smoke dispersion from the major wildfire events of August 2007 in Peloponnese.

## Earth Observation / Modeling synergies in BEYOND

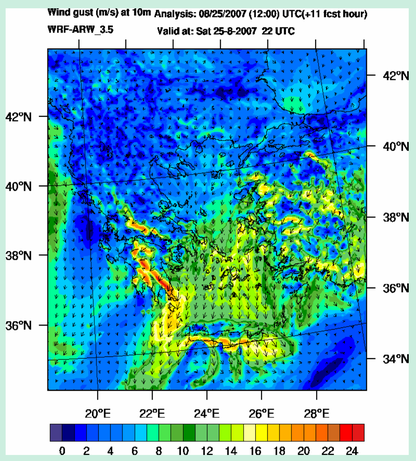



## Meteorological conditions

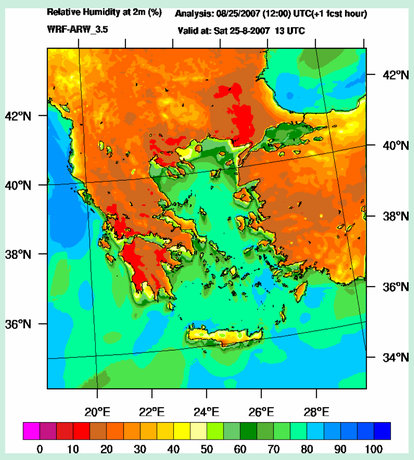
On 25 August 2007 strong NE winds with gusts exceeding 20 m/s, temperatures over 40°C and very low relative humidity favored the rapid development of severe wild fires in western Peloponnese. Smoke from these fires advected towards Mediterranean due to the prevailing N and NE winds during 25-27 August 2007.




Temperature and geopotential height at 500mb




Wind gust at 10m (m/s

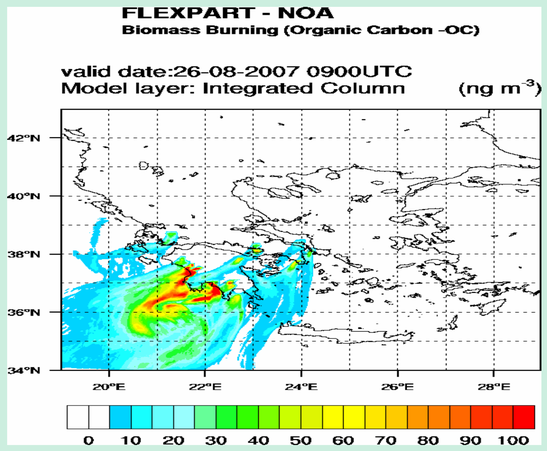



Relative humidity at 2m (%)

## Smoke dispersion

Location and duration of each fire spot is obtained from the MSG/SEVIRI Fire Monitoring Service of NOA (Kontoes at el., 2013). Plume heights are characterized from MISR observations (Sofiou et al. 2013). Using the above input, WRF/FLEXPART (Brioude at al., 2013) simulations of smoke dispersion indicate a satisfactory reproduction of the smoke properties in space and time.

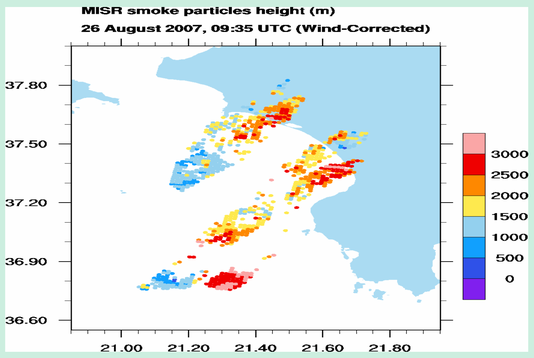
Dispersion of smoke, MODIS 26 August 2007 09:30 UTC



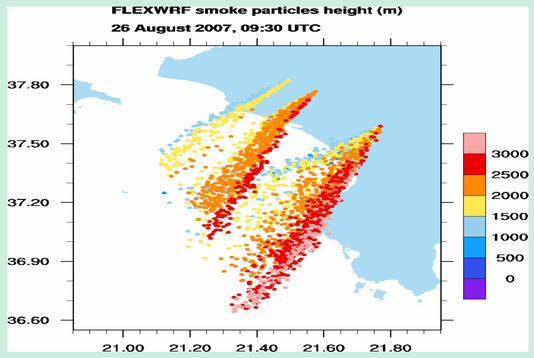

Dispersion of smoke, FLEXWRF 26 August 2007 09:00 UTC

## Vertical smoke structure

MISR data is processed for four major smoke plumes and corresponding simulations of smoke dispersion with FLEXPART are compared to satellite retrievals. Several properties of the vertical structure of the plumes are reproduced in the model. For example, smoke particles elevate higher than 3km as the plumes move towards southwest while the northern plumes show weaker advection and reach lower altitudes. However, wildfire smoke dispersion is a dynamically evolving phenomenon and it is difficult to extract generic results from the comparison with satellite snapshots.




MISR smoke heights




FLEXPART smoke heights

## Concluding Remarks

- Development of a synergistic satellite and modeling technique indicates the ability to adequately simulate dispersion of smoke from wildfires.
- Initialization of FlexWrf from MSG/SEVIRI and MISR observations (fire locations, fire durations, injection heights) improved the model results compared to MISR and MODIS images.
- Plume rise above the fire spot is the most critical parameter in terms of smoke dispersion forecasting.
- 3-D observations of smoke plumes are very sparse.
- More work is underway on the implementation of a plume rise module for wildfire smoke in order to estimate injection heights based on fuel properties and atmospheric processes.

## References

Brioude J., D.Arnold, A. Stohl , et al.,: The Lagrangian particle dispersion model FLEXPART-WRF version 3.1, Geosci.Model Dev., 6, 1889-1904, /doi:10.5194/gmd-6-1889-2013, 2013

IPCC, Climate Change 2013: The Physical Science Basis, 2013

Kontoes C, I. Papoutsis, T. Herekakis, N. Sifakis. Wildfire Rapid Detection and Mapping and Post-fire Damage Assessment in Greece. In Earthzine magazine, 2013

Sofiou F. I., V. Amiridis, N. Mihalopoulos Smoke plume characteristics over Greece using space-based multiangle imaging,1st Intern. Conf. on Rem. Sensing and Geoinf. 2013, Paphos, Cyprus 8-10 April, 2013

**Acknowledgments:** The present work is supported by the EU FP7 Program BEYOND, Project GA number:316210