

ANR STRAP

Réunion de démarrage du projet

Mardi 07 Octobre 2014

Work-Package 2

**Convective Plume: fluxes, dynamics and
modelling**

Coordinators : M. Gouhier and E. Kaminski

WP2 ⇒ **Convective Plume: fluxes, dynamics and modelling**

Milestone :

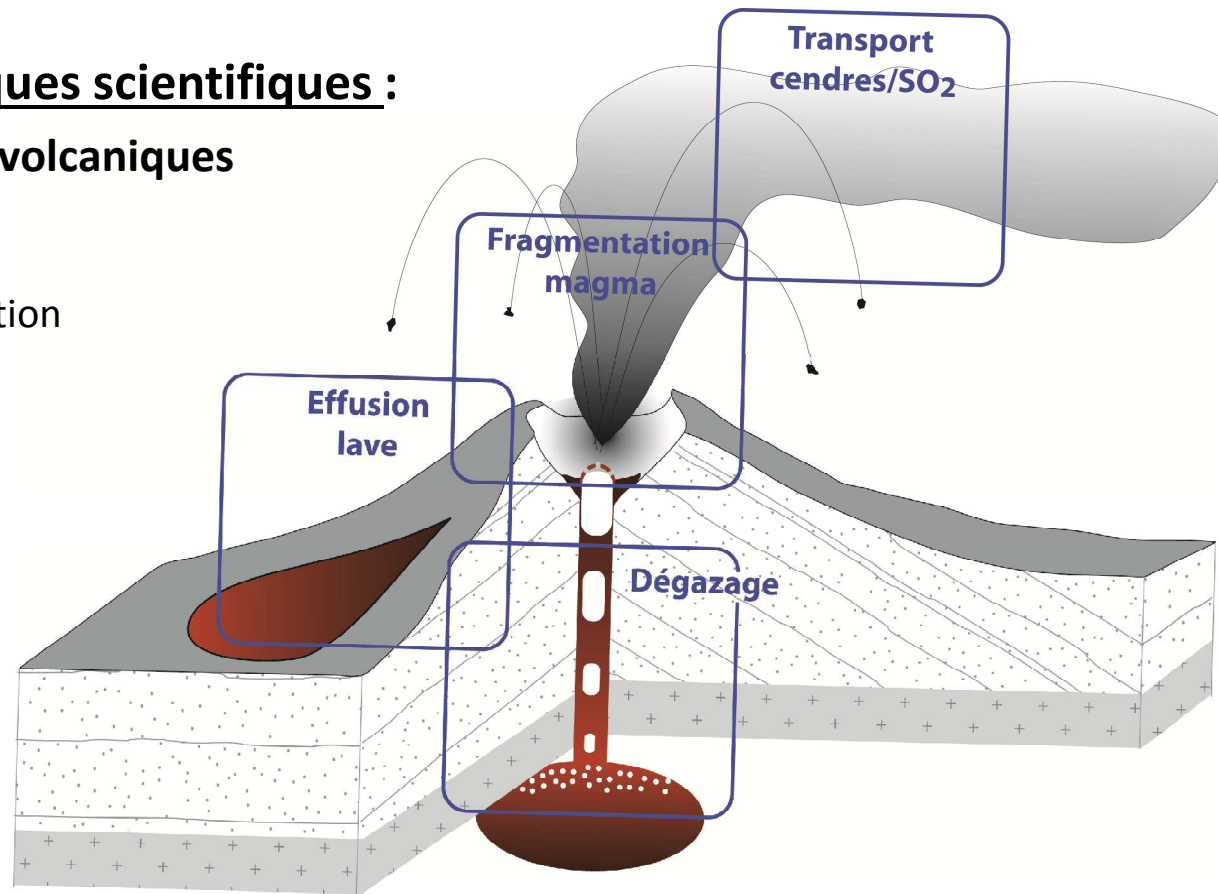
- **WP2_A**- Source data collection and lava flows modelling (2015/2016)
- **WP2_B** - Measurements of gas and aerosols from small size volcanic plumes (2015/2016)
- **WP2_C** - Dense convective plumes: measurements and modelling (2015/2017)

WP2 ⇒ Convective Plume: fluxes, dynamics and modelling

❖ Thématiques scientifiques :

Processus volcaniques

- Dégazage
- Effusion
- Fragmentation
- Transport

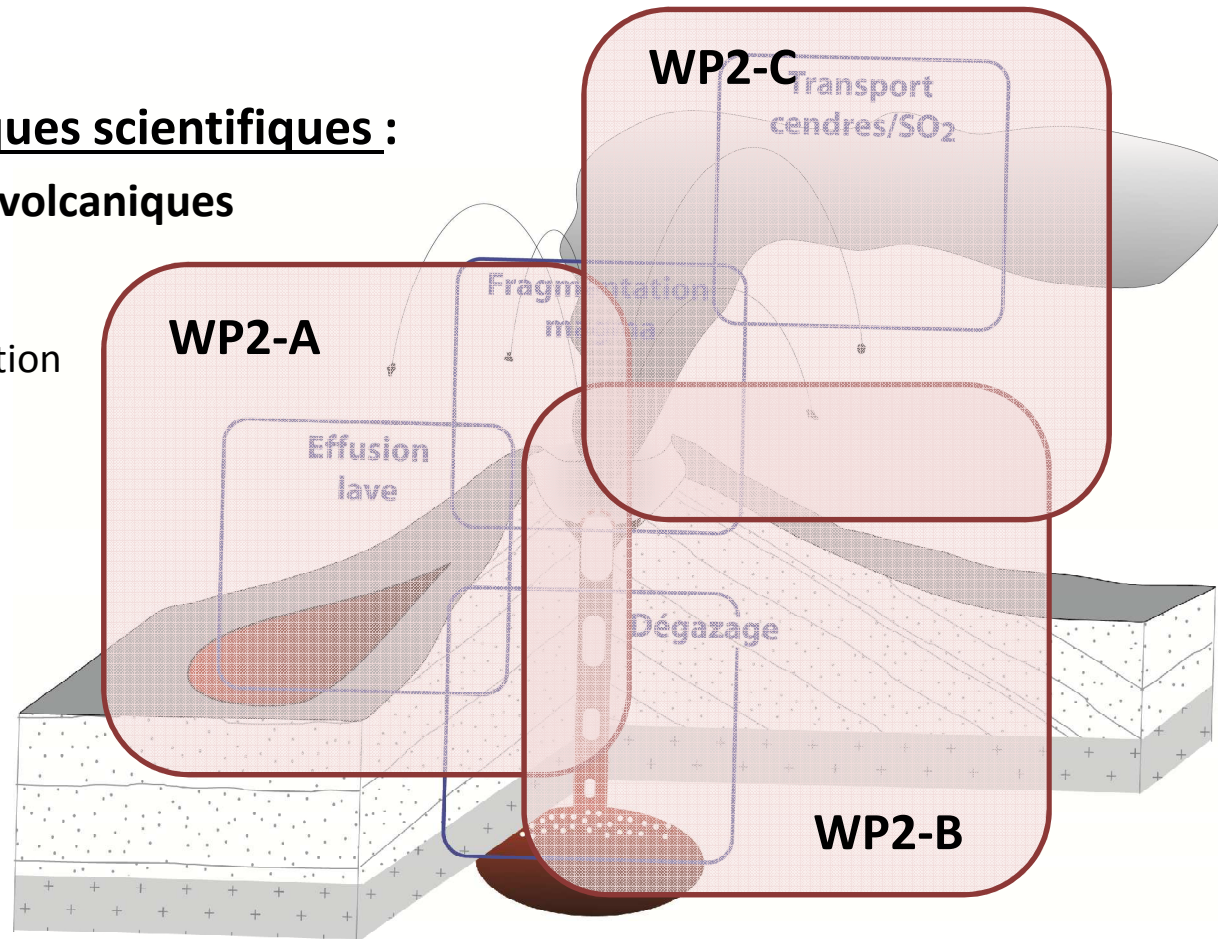


WP2 ⇒ Convective Plume: fluxes, dynamics and modelling

❖ Thématiques scientifiques :

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WP2 ⇒ **Convective Plume: fluxes, dynamics and modelling**

WP2-A: Source data collection and lava flows modelling

Task 2A.1: Sediment analysis and Pyroclasts textures - Field measurements (*L.Gurioli, P. Bachèlery, A. DiMuro*)

Task 2A.2: Lava flow heat and volume flux
(*A.Harris, J-L. Froger, M. Gouhier, N. Villeneuve*)

Task 2A.3: Lava flow: thermal model
(*N.Villeneuve, A.Harris, L. Gurioli*)

WP2 ⇒ **Convective Plume: fluxes, dynamics and modelling**

WP2-B: Measurements of gas and aerosols from small size volcanic plumes

Task 2B.1: Vent-leaving plume dynamics
(A.Harris)

Task 2B.2: Source volatile budget
(A.DiMuro, S.Moune)

Task 2B.3: Near-vent gas and aerosol measurements
(S.Moune, A.DiMuro, M.Gouhier, N.Villeneuve)

WP2 ⇒ **Convective Plume: fluxes, dynamics and modelling**

WP2-C: Dense convective plumes: measurements and modelling

Task 2C.1: Measurements of ash-rich volcanic plumes

(M.Gouhier, F.Donnadieu)

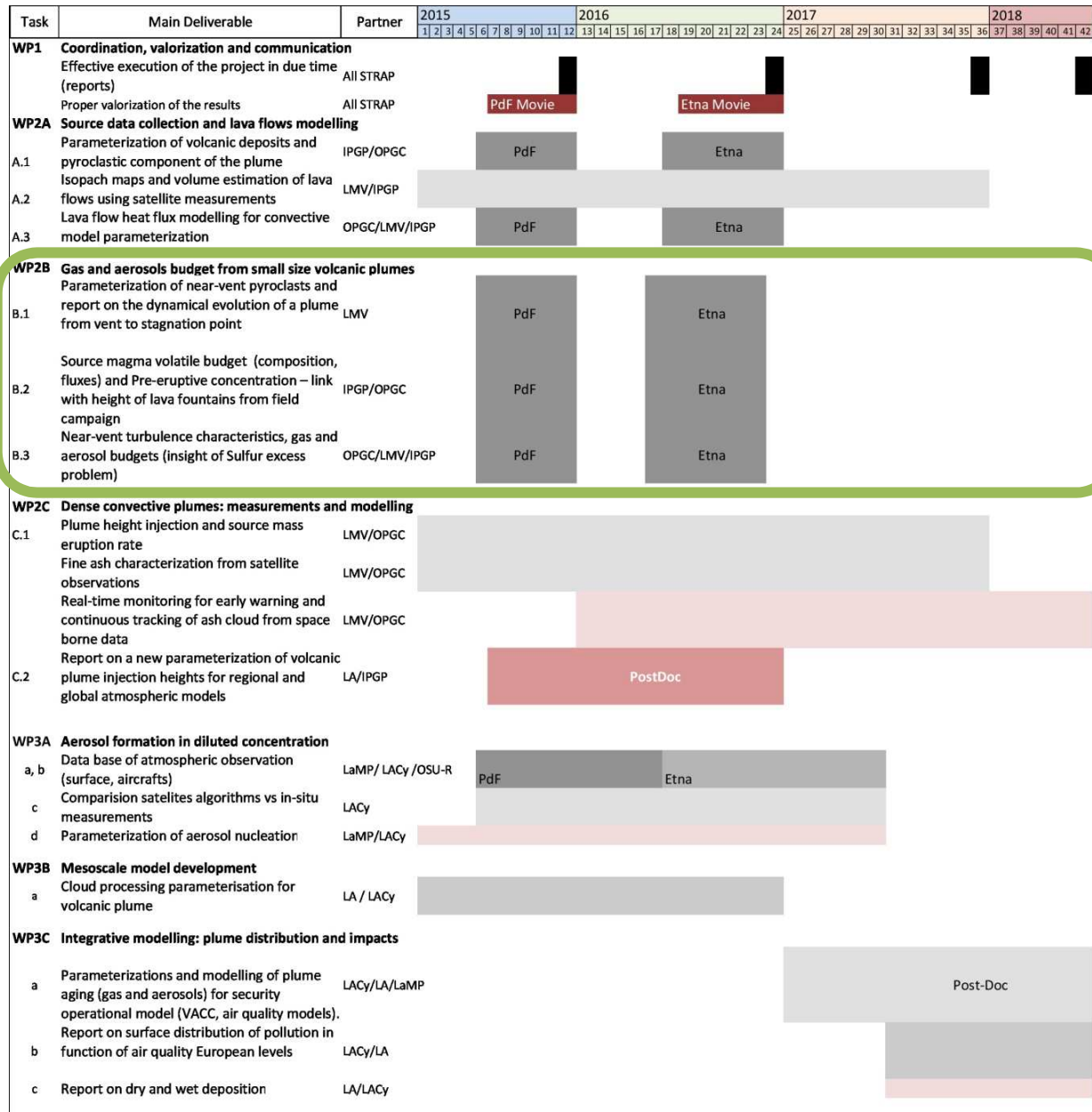
Task 2C.2: Volcanic plume injection heights for regional and global atmospheric models

(E.Kaminski, C.Mari, G.Roberts)

CALENDRIER PREVISIONNEL

Task	Main Deliverable	Partner	2015												2016												2017												2018											
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42						
WP1	Coordination, valorization and communication																																																	
	Effective execution of the project in due time (reports)	All STRAP																																																
WP2A	Source data collection and lava flows modelling																																																	
A.1	Parameterization of volcanic deposits and pyroclastic component of the plume	IPGP/OPGC													PdF																		Etna																	
A.2	Isopach maps and volume estimation of lava flows using satellite measurements	LMV/IPGP																																																
A.3	Lava flow heat flux modelling for convective model parameterization	OPGC/LMV/IPGP													PdF																		Etna																	
WP2B	Gas and aerosols budget from small size volcanic plumes																																																	
B.1	Parameterization of near-vent pyroclasts and report on the dynamical evolution of a plume from vent to stagnation point	LMV													PdF																		Etna																	
B.2	Source magma volatile budget (composition, fluxes) and Pre-eruptive concentration – link with height of lava fountains from field campaign	IPGP/OPGC													PdF																		Etna																	
B.3	Near-vent turbulence characteristics, gas and aerosol budgets (insight of Sulfur excess problem)	OPGC/LMV/IPGP													PdF																		Etna																	
WP2C	Dense convective plumes: measurements and modelling																																																	
C.1	Plume height injection and source mass eruption rate	LMV/OPGC																																																
	Fine ash characterization from satellite observations	LMV/OPGC																																																
	Real-time monitoring for early warning and continuous tracking of ash cloud from space borne data	LMV/OPGC																																																
C.2	Report on a new parameterization of volcanic plume injection heights for regional and global atmospheric models	LA/IPGP													PostDoc																																			
WP3A	Aerosol formation in diluted concentration																																																	
a, b	Data base of atmospheric observation (surface, aircrafts)	LaMP/ LACy /OSU-R													PdF																		Etna																	
c	Comparison satellites algorithms vs in-situ measurements	LACy																																																
d	Parameterization of aerosol nucleation	LaMP/LACy																																																
WP3B	Mesoscale model development																																																	
a	Cloud processing parameterisation for volcanic plume	LA / LACy																																																
WP3C	Integrative modelling: plume distribution and impacts																																																	
a	Parameterizations and modelling of plume aging (gas and aerosols) for security operational model (VACC, air quality models). Report on surface distribution of pollution in function of air quality European levels	LACy/LA/LaMP																									Post-Doc																							
b	Report on surface distribution of pollution in function of air quality European levels	LACy/LA																																																
c	Report on dry and wet deposition	LA/LACy																																																

CALENDRIER PREVISIONNEL



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DELIVERABLES

WP2.A	Period: 2015-2016	Expected outcomes
(1)	Parameterization of volcanic deposits and pyroclastic component of the plume from field campaign at PdF (06/2015) and Etna (06/2016)	Source parameters, database for scientific community
(2)	Isopach maps and volume estimation of lava flows using satellite measurements (from 01/01/2015 for all targets)	Source parameters, database for scientific community
(3)	Lava flow heat flux modelling for convective model parameterization from field campaign at PdF (06/2015) and Etna (06/2016)	Inputs of WP2.C - Source parameters, database for scientific community
WP2.B	Period: 2015-2016	Expected outcomes
(1)	Parameterization of near-vent pyroclasts and report on the dynamical evolution of a plume from vent to stagnation point from field campaign at PdF (06/2015) and Etna (06/2016)	Inputs of WP2.C - Validation of spatial observation
(2)	Source magma volatile budget (composition, fluxes) and Pre-eruptive concentration – link with height of lava fountains from field campaign at PdF (06/2015) and Etna (06/2016)	Database for scientific community, improvement of fundamental knowledge
(3)	Near-vent turbulence characteristics, gas and aerosol budgets (insight of Sulfur excess problem) from field campaign at PdF (06/2015) and Etna (06/2016)	Inputs of WP2.C - improvement of fundamental knowledge
WP2.C	Period: 2015-2017	Expected outcomes
(1)	Plume height injection and source mass eruption rate (from 01/01/2015)	Source parameters, Inputs of WP2.C2 - risks mitigation
(2)	Fine ash characterization from satellite observations (from 01/01/2015)	Source parameters, Inputs of WP2.C2 - risks mitigation
(3)	Real-time monitoring for early warning and continuous tracking of ash cloud from space borne data (from 01/01/2015)	Societal protection (air routes, aviation safety), risks mitigation
(4)	Report on a new parameterization of volcanic plume injection heights for regional and global atmospheric models. (from summer 2015)	Inputs of WP3 - Societal impacts, climate models. Weather forecasting centres

Requested financial contribution: 183 k€

Partner LA: 76 ke

- 18 months of post-doctoral position shared between LA and IPGP for “Numerical modelling of turbulent volcanic plume, adaptation of Meso-NH”. – 75 k€
- Postdoc mobility (Paris/Toulouse) – 1 k€

Partner IPGP: 20 k€

- 7 k€ for Multigas set
- 5 k€ for petrological and geochemical analysis (SEM + thin sections + epoxy)
- 2 k€ for 4 thermocouples (2 lava and 2 fumaroles)
- 6 k€ for scientific publication and meetings

Partner OPGC: 45 k€

- 25 k€ for two ash collectors
- 10 k€ for missions to Piton de la Fournaise (2 missions, 4 people)
- 4 k€ for Freight transport for ground-based instrument of LMV/OPGC on PdF
- 6 k€ for scientific publication and meetings

Partner LMV: 42k€

- 25 k€ IR-T Cyclops bolometers
- 6 k€ for missions to Etna (2 missions, 3 people)
- 5 k€ for petrological and geochemical analysis (Sample shipping, microprobe, LA-ICP-MS, raman + FTIR, Bulk rock analyses)
- 6 k€ for scientific publication and meetings

Task 2A.1: Sediment analysis and Pyroclasts textures - Field measurements *(L.Gurioli, P. Bachèlery, A. DiMuro)*

Historical deposits :

Activité effusive + explosive

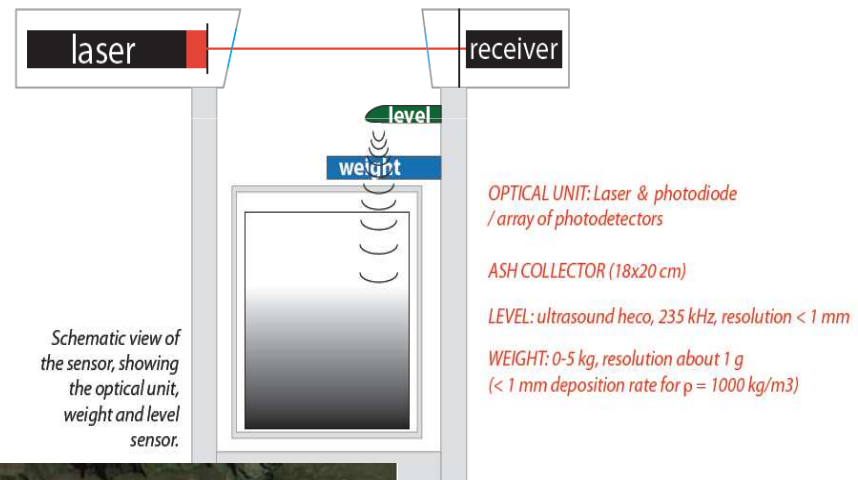
Échantillonnage terrain

Activité ancienne (1800,1874,Chisny)

⇒ Mission PF 2014
(L. Gurioli)

⇒ Projet commun CT3
INSU (activité ancienne)

Active ash fallout : Ash collector (Targets = Etna + Stromboli)



Task 2A.2 + Task 2B.1

(A.Harris, J-L. Froger, M. Gouhier, N. Villeneuve)

Space-borne Remote sensing :

Activité effusive at PF (TADR)

Methodo = INSAR + GEO-LEO TIR
imagery + Visible imagery
(Stereophotogrammetry)

Ground-based Remote sensing :

Campagne Etna : June 2014

Methodo = FLIR and SO2 camera

Mission = Etna 2016 with TIR
radiobolometer for ash and SO2
(M.Gouhier)

Task 2A.3: Lava flow: thermal model

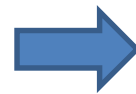
(N.Villeneuve, A.Harris, L. Gurioli)

Activité effusive at PF (heat flux)

Methodo = Petro-geological analysis
+

Campagne de terrain : Janvier 2015

(A.Harris, N.Villeneuve)



Heat loss modelling =>
source of plume buoyancy

++ Master 2 student (Maeva Rhety)

⇒ Lien avec WP2-C2

Task 2B.2: Source volatile budget (Expected emissions)

(A.DiMuro, S.Moune)

- Glass, fluid inclusion, mineral analysis
- Modeling of degassing paths (equilibrium vs. Disequilibrium)
(Collaboration with M. Venturi – INGV Pisa)
- Comparison with Measured emissions (2B.3)
- Correlation with textures of eruptive products (2A.1)

Budget: 5keuros (petrology and geochemistry)

Mission : *Severine Moune* PF – 2014 ↕

Task 2B.3: Near-vent gas and aerosol measurements

(S.Moune, A.DiMuro, M.Gouhier, N.Villeneuve)

Old Budget: 7keuros (acquisition of new MultiGas device)

New budget:

2 missions from and to INGV Pisa (1 keuros)

2 missions to Réunion Island (6 keuros) ADM moves to IPGP-Paris in July 2015

Mission : *M.Gouhier+F.Donnadieu+S.Moune* Etna 2015/2016 via CNES TOSCA project

Lien avec le WP2-C1

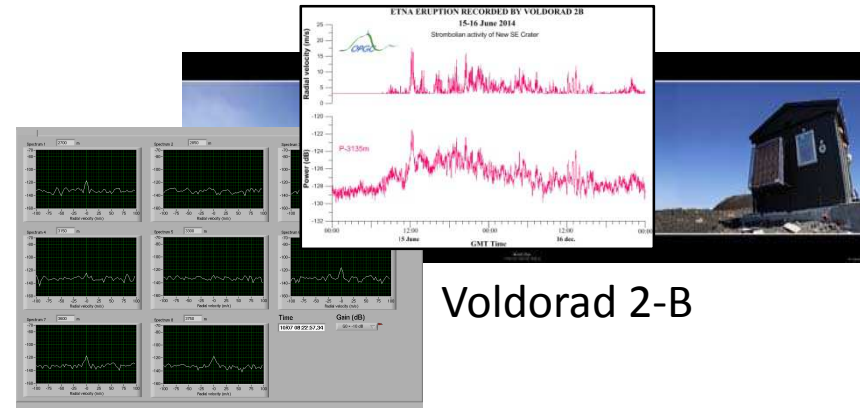
Task 2C.1: Measurements of ash-rich volcanic plumes (M.Gouhier, F.Donnadieu)

Ground-based Remote sensing :

Activité explosive (Etna + Stromboli)

Methodo = Radar Doppler – INGV catania

+ TIR radiobolometer (Ash + SO₂)



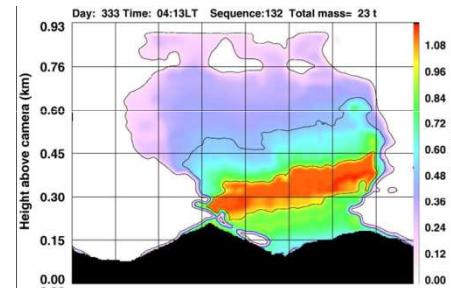
Voldorad 2-B

Space-borne Remote sensing :

Activité explosive (at Etna + autres)

Methodo = GEO-LEO TIR imagery (HotVolc BDD + Capabilities)

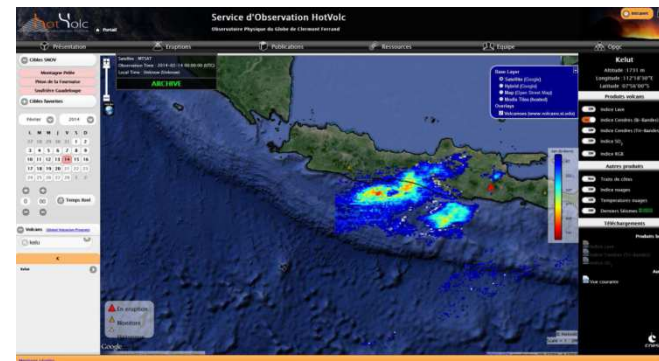
⇒ [Lien avec WP2-C2](#)



Ash loading : (Prata and bernardo 2009)



TIR Multi-bolometer



Task 2C.2: Volcanic plume injection heights for regional and global atmospheric models

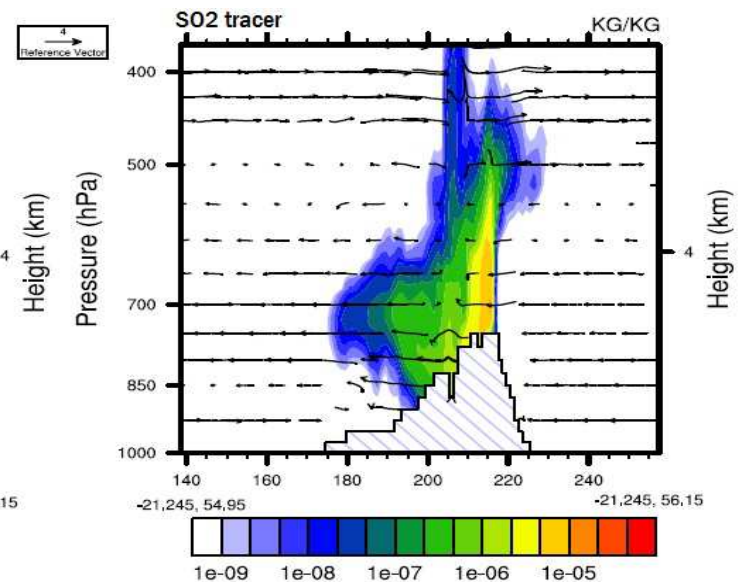
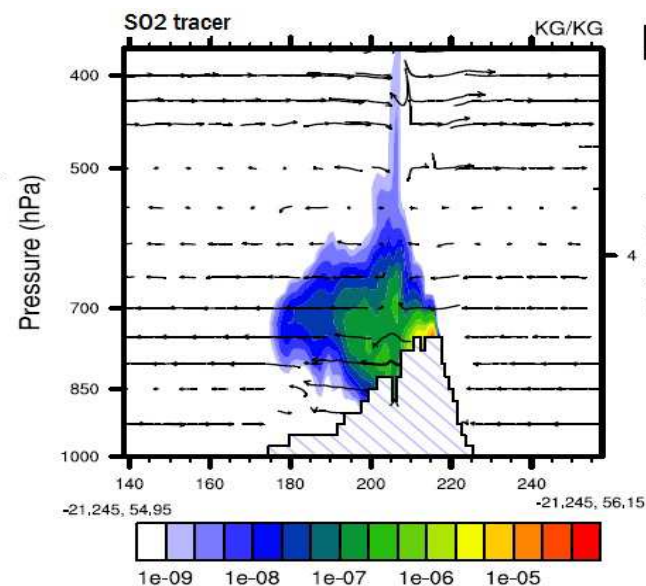
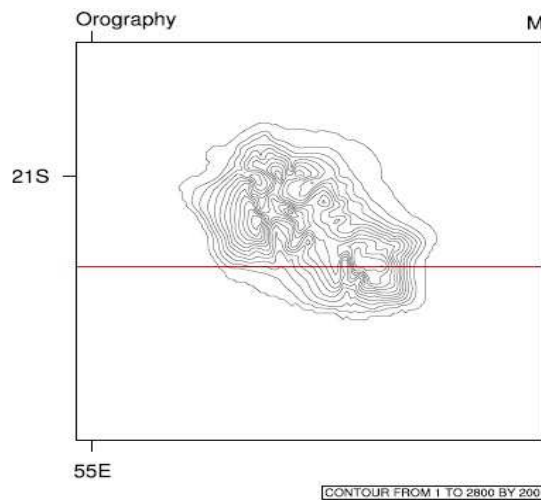
(E.Kaminski, C.Mari, G.Roberts)

Modelling :

Activité explosive (PF + Etna? + Stromboli?)

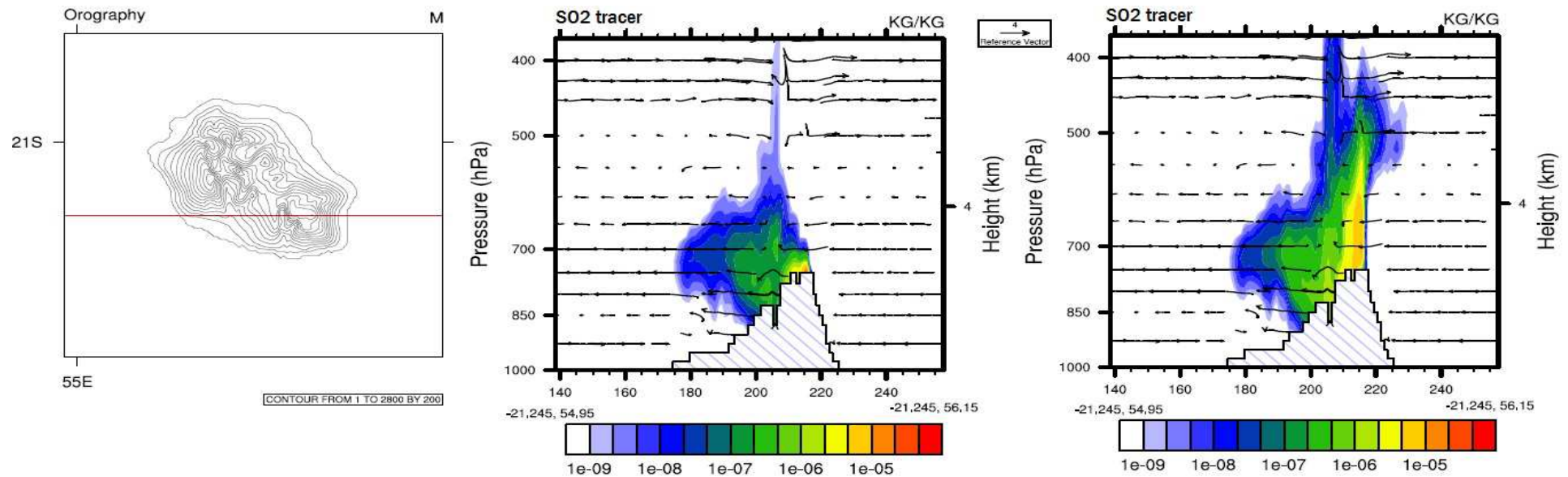
PostDoc = 18 mois

Objectifs : Improved parameterization of volcanic plume injection heights => regional + global atmospheric models



Task 2C.2: Volcanic plume injection heights for regional and global atmospheric models

(E.Kaminski, C.Mari, G.Roberts)



Perspectives :

- Tester la paramétrisation pour différentes éruptions (en terme de sources de chaleur volcaniques, cas idéalisés et réels).
- Le réglage de l'entraînement et du déentraînement doit être testé pour différentes éruptions . Un réglage universel applicable à différents cas d'éruption doit être recherché (ANR STRAP 2014/2017).

* Pergaud, J., Masson, V., Malardel, S., and Couvreur, F.: A parameterization of dry thermals and shallow cumuli for mesoscale numerical weather prediction, Bound.-Lay. Meteorol., 132, 83–106, 2009.

** www.mesonh.aero.obs-mip.fr.