



Istituto Nazionale di  
Geofisica e Vulcanologia



FINNISH METEOROLOGICAL INSTITUTE

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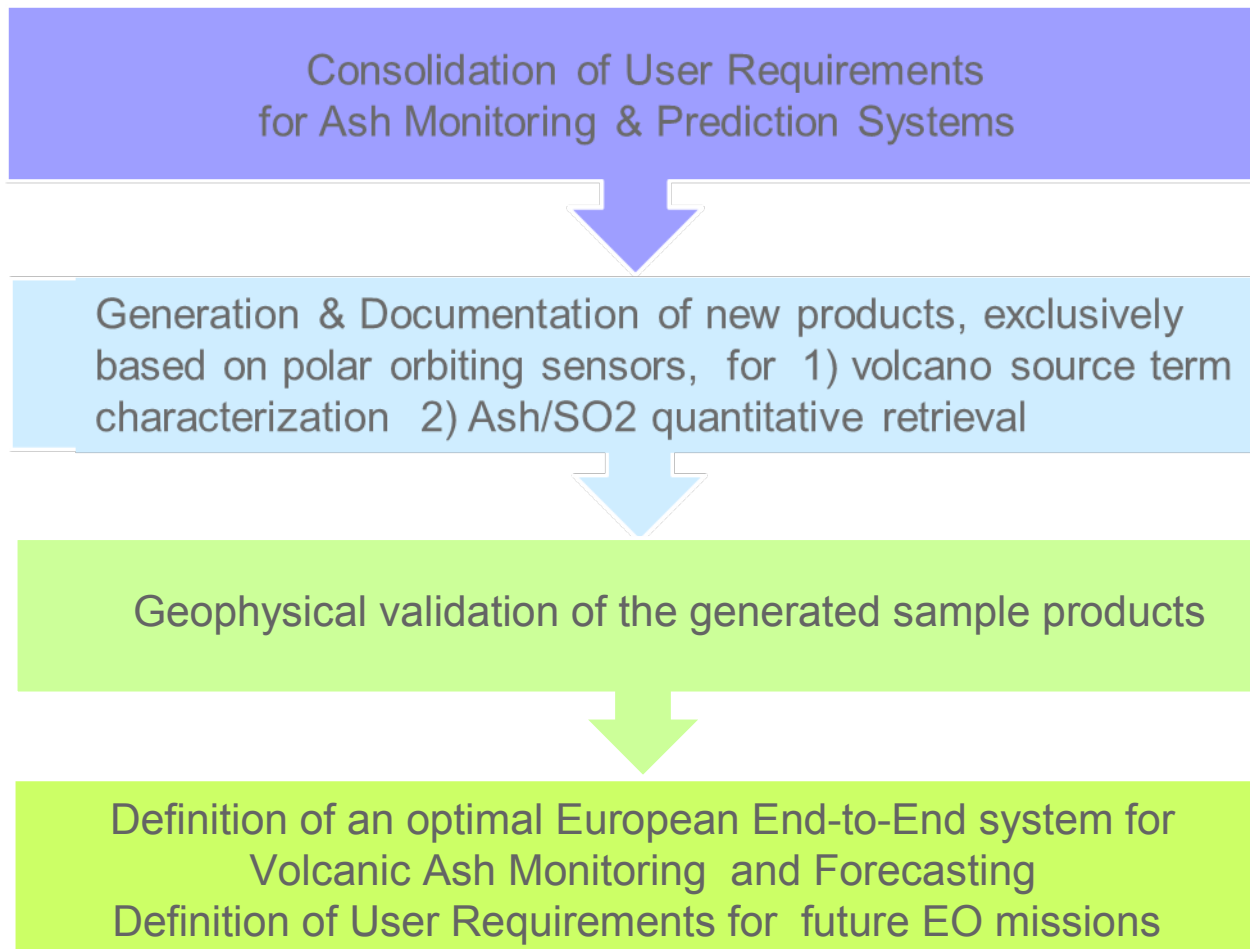
SPACE SYSTEMS

# STUDY ON AN END-TO-END **SYSTEM** FOR VOLCANIC **ASH** PLUME MONITORING AND PREDICTION : SMASH

# Summary

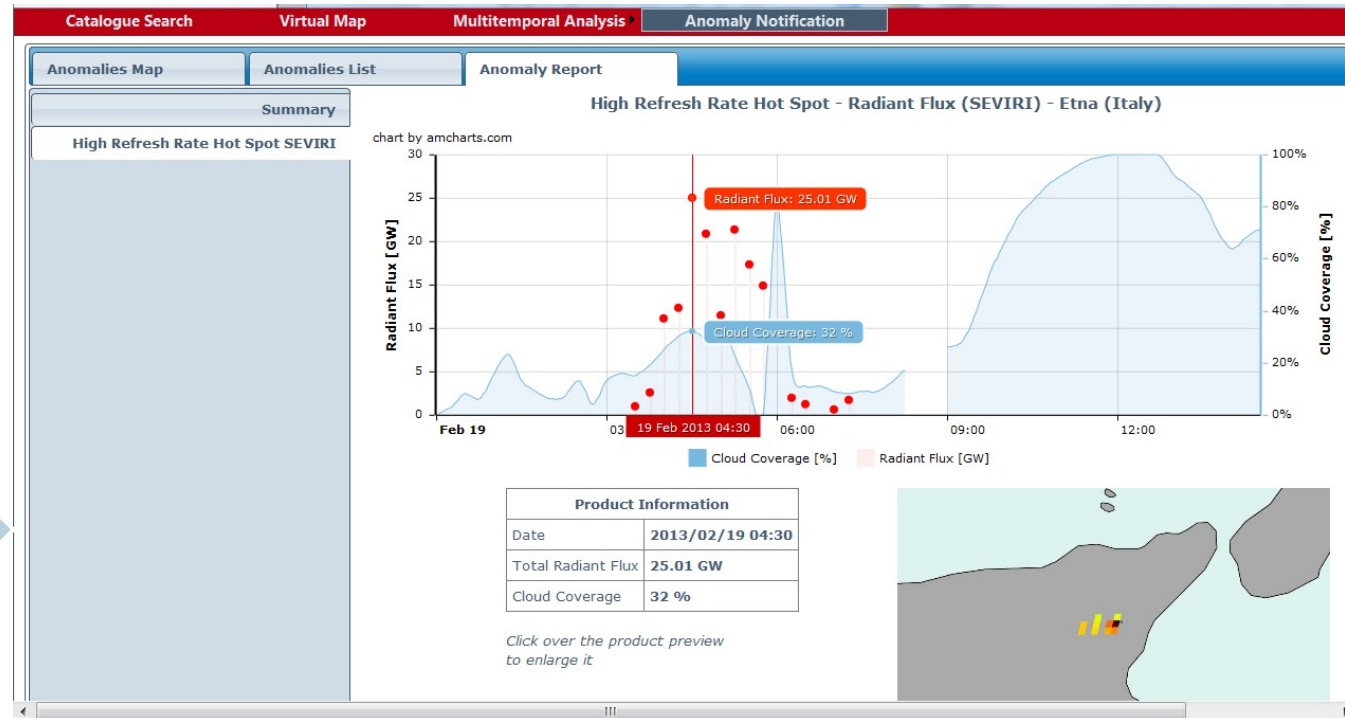
- Project Objectives & Heritage
- Team Organization and Expertise
- Study Logic
- New Products Portfolio
- Synergies with Parallel Project SACS-2

## Objectives

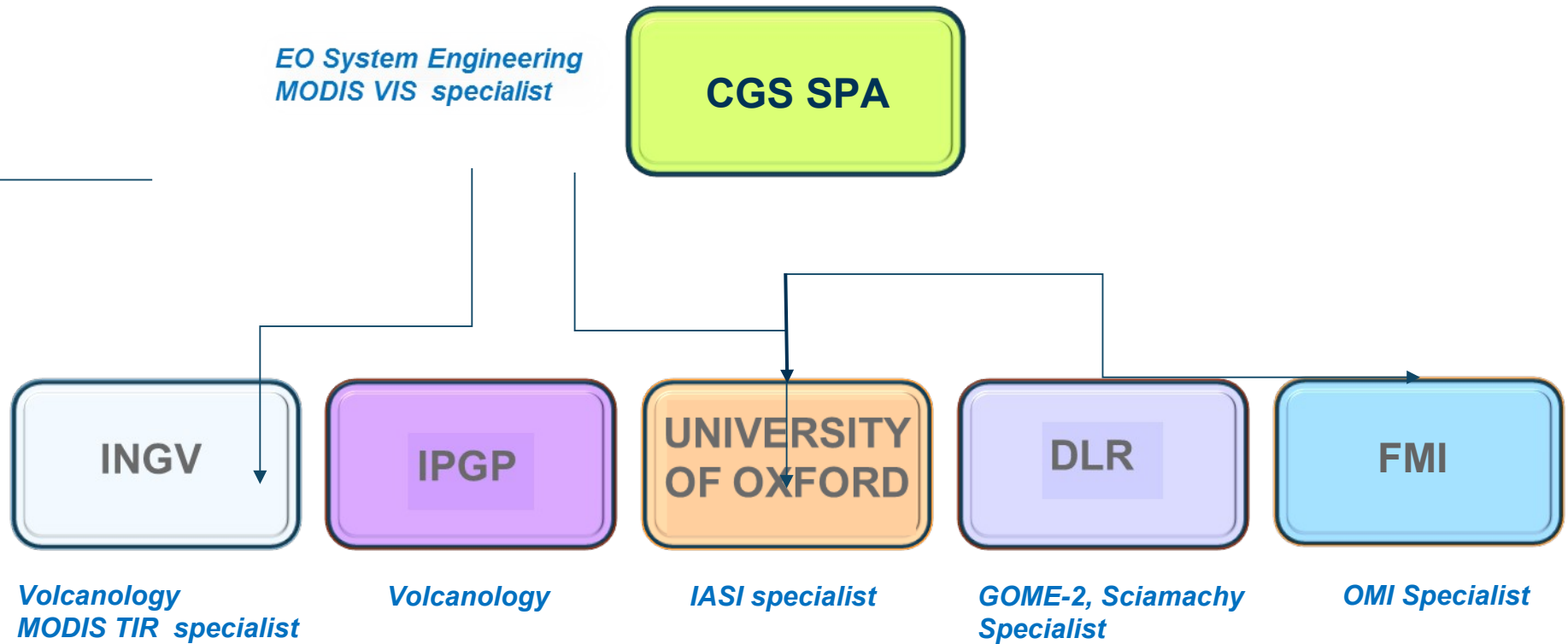


## Heritage

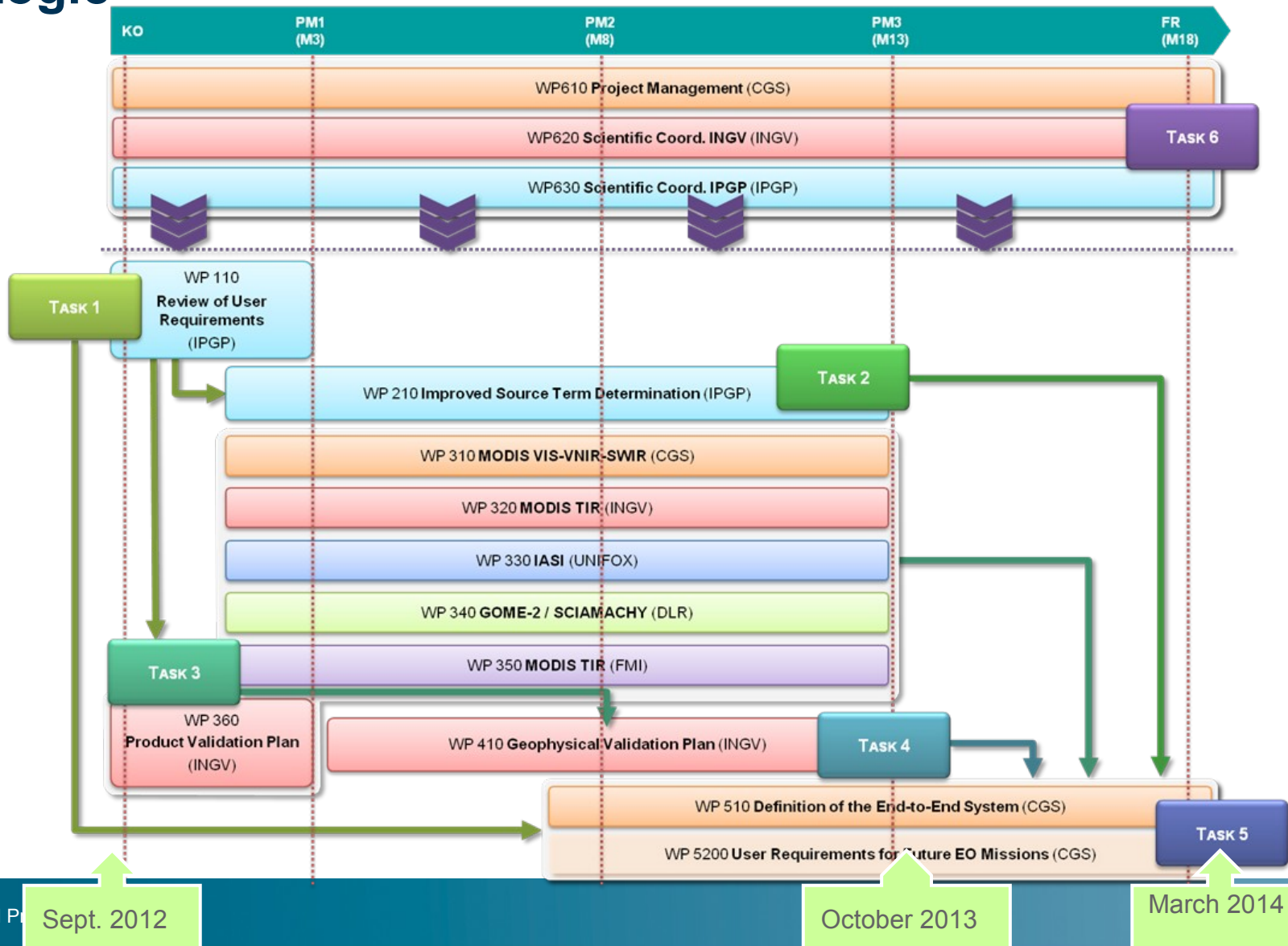
- SMASH CORE TEAM is based on FP7 EVOSS and ESA DUE GLOBVOLCANO project core teams ( IPGP & CGS)
- EVOSS system Currently Operational



## Team Structure and Expertise



## Study Logic



## List of proposed Source Term Determination Products

Product ID	Product Name	Product Description	Improved /New	Meas. Unit	Resp.
RADF	GVLC-SP-CGS-001	Radiant flux associated to lava eruption	I	W	IPGP
TDRE	GVLC-SP-CGS-001_TDRE	Lava Discharge Rate, effusive model	I	kg s <sup>-1</sup>	IPGP
TDRF	GVLC-SP-CGS-001_TDRF	Mass Eruption Rate, fire fountain model	N	kg s <sup>-1</sup>	IPGP
TDRX	GVLC-SP-CGS-001_TDRX	Mass Eruption Rate, explosive model	N	kg s <sup>-1</sup>	IPGP
HEIGH	GVLC-SP-CGS-001_H	Height of column	N	m	IPGP
GRSZDI	SMSH-GRSZDI	Grain Size Distribution	N	µm	IPGP
SO2VFX	SMSH-SO2VFX	SO2 Vertical Flux volcanic edifice scale	N	t d <sup>-1</sup>	IPGP

## **Volcanic Source Term Characteristics / Determination**

### **Eruption regimes:**

- 1. Lava Flow: Weak or no ash production**
- 2. Fire fountaining: Moderate ash production, Relatively low dilution by mixing with air, Low eruption column (~1 km.)**
- 3. “Plinian” Column: Strong ash production, Strong dilution with air, High eruption column (~10 km.)**



## Volcanic Source Term Characteristics / Determination

Approach combines physical modelling of the volcanic source and remote sensing.

- **Mass flux** at the volcanic source
- If explosive activity (fragmented magma ejected from the vent by volcanic gases), **Grain size distribution** important.
- If high column, **Atmospheric stratification** important

Remote sensing and modelling together should identify combinations: Height, Ash loading, Grain size distribution at injection height .... in progress

**Overall size of event .....**

## List of Proposed ASH Products

Product ID	Product Name	Product Description	Improved /New	Meas. Unit	Responsible
IASI-ASH-COL	ASH Column by IASI	Ash total column (mass loading) map by IASI sensor	N	t/km <sup>2</sup>	UNIOXF
IASI-ASH-CNC	ASH Concentration by IASI	Ash concentration map by IASI sensor	N	mg/m <sup>3</sup>	UNIOXF
IASI-ASH-HEI	ASH Height by IASI	ASH Height map by IASI sensor	N	km	UNIOXF
IASI-ASH-FCOL	ASH Fast Column by IASI	Fast detection map of ash column amount (linear retrieval) by IASI sensor	N	t/km <sup>2</sup>	UNIOXF
IASI-ASH-REF	ASH TIR effective radius by IASI	ASH TIR effective radius by IASI	N	μ m	UNIOXF
MOD-ASH-REF	ASH Effective Radius by MODIS	Ash effective radius map by MODIS sensor (improved by use of UNIOXF database)	I	μ m	INGV - CGS
MOD-ASH-HEI	Ash Height by MODIS	Ash Height map by MODIS sensor	N	km	INGV
MOD-ASH-FLU	Ash Flux by MODIS	Ash flux time series reconstruction by MODIS sensor (improved )	I	t/day	INGV
MOD-ASH-COL	Ash Column by MODIS	Ash total column map using VIS and TIR channels by MODIS sensor	N	t/km <sup>2</sup>	INGV-CGS
MOD-ASH-CNC	Ash Concentration by MODIS	Ash concentration map using VIS and TIR channels by MODIS sensor	N	mg/m <sup>3</sup>	INGV-CGS
OMI-ASH-HEI	ASH height by OMI	ASH height map derived by OMI products	N	Km	FMI

## List of Proposed SO<sub>2</sub> Products

Product ID	Product Name	Product Description	Imp /New	Meas. Unit	Responsible
OMI-SO <sub>2</sub> -HEI	SO <sub>2</sub> Height by OMI	SO <sub>2</sub> Height map derived by OMI products	N	km	FMI
GM2-SO <sub>2</sub> -HEI	SO <sub>2</sub> Height by GOME-2	SO <sub>2</sub> Height map by GOME-2 sensor (improved)	I	km	DLR
GM2-SO <sub>2</sub> -COL	SO <sub>2</sub> Column by GOME-2	SO <sub>2</sub> total column map by GOME-2 sensor (improved)	I	t/km <sup>2</sup>	DLR
SCH-SO <sub>2</sub> -COL	SO <sub>2</sub> Column by Sciamachy	SO <sub>2</sub> total column map by Sciamachy sensor	I	t/km <sup>2</sup>	DLR
IASI-SO <sub>2</sub> -COL	SO <sub>2</sub> Column by IASI	SO <sub>2</sub> total column map by IASI sensor	N	t/km <sup>2</sup>	UNIOXF
IASI-SO <sub>2</sub> -HEI	SO <sub>2</sub> Height by IASI	SO <sub>2</sub> Height map by IASI sensor	N	km	UNIOXF
IASI-SO <sub>2</sub> -FCOL	SO <sub>2</sub> Fast Column by IASI	Fast detection map of SO <sub>2</sub> column amount (linear retrieval) by IASI sensor	N	t/km <sup>2</sup>	UNIOXF
MOD-SO <sub>2</sub> -COL87	SO <sub>2</sub> Column at 8.7 $\mu$ m by MODIS	SO <sub>2</sub> total column map at 8.7 $\mu$ m by MODIS sensor (improved)	I	t/km <sup>2</sup>	INGV
MOD-SO <sub>2</sub> -COL73	SO <sub>2</sub> Column at 7.3 $\mu$ m by MODIS	SO <sub>2</sub> total column map at 7.3 $\mu$ m by MODIS sensor (improved)	I	t/km <sup>2</sup>	INGV
MOD-SO <sub>2</sub> -FLU	SO <sub>2</sub> Flux by MODIS	SO <sub>2</sub> flux time series reconstruction by MODIS sensor (improved)	I	t/day	INGV

# Synergies with parallel SACS 2

- USER REQUIREMENTS : SMASH focused on Volcano Observatories requirements , whereas SACS on Aviation requirements
- VALIDATION PLAN : co-ordinated product validation for both projects (same test cases )
- VALIDATION : INGV will validate products from both teams on ETNA test cases, UNI Thessaloniki will validate products from both teams on ICELAND test cases
- CROSS-COMPARISON of analogue products from each team
- JOINED PROGRESS MEETINGS

**Thank you !**