

PRÉSENTATION DU MODÈLE FLAME (Forecasting Landslides Accelerations induced by Meteorological Events)

Vidéo Décembre 2020
Séminaire final de communication
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Progetto Interreg Alcotra n°1573 “AD-VITAM”

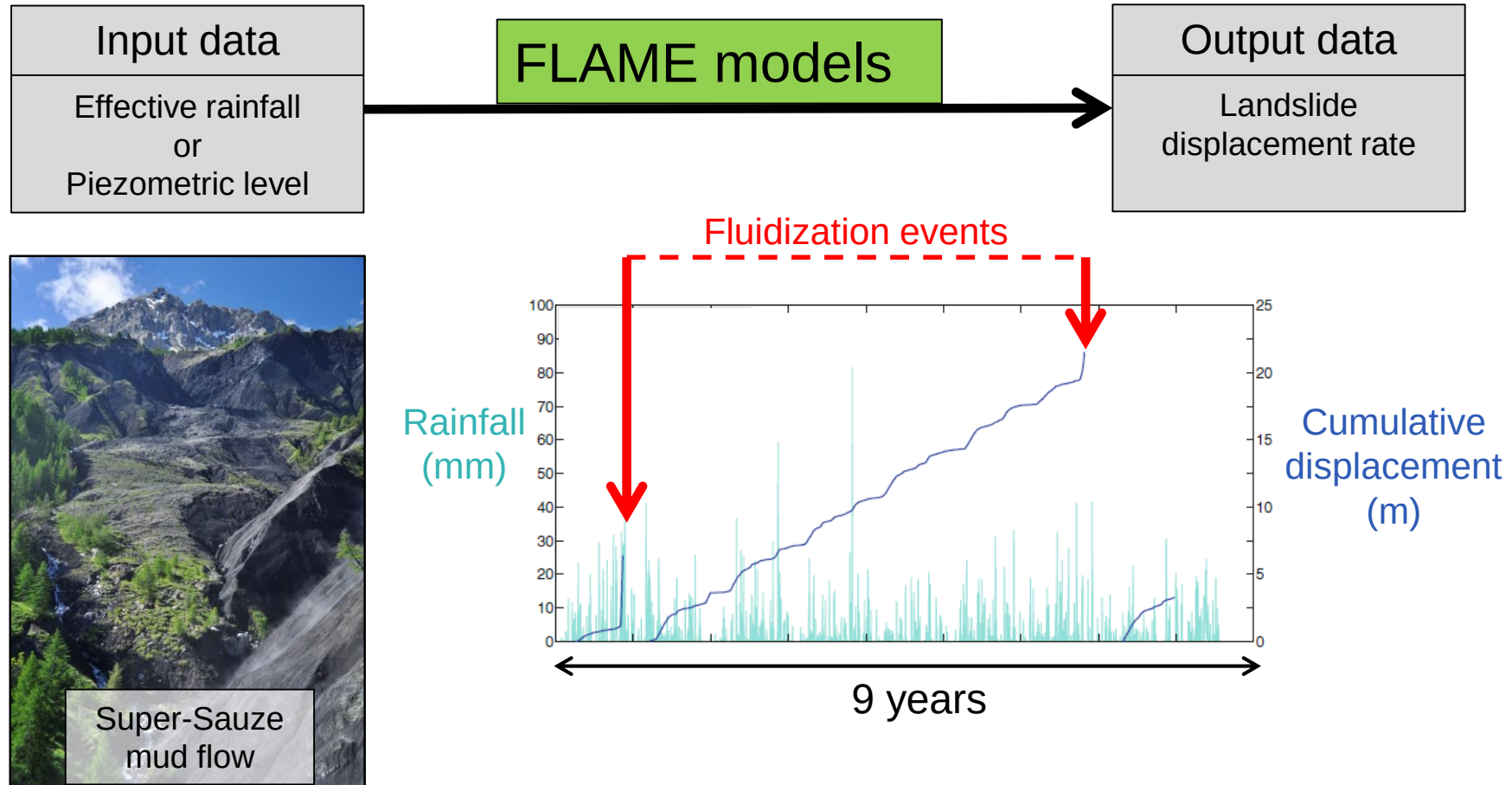
Projet Interreg Alcotra n°1573 “AD-VITAM”

SOMMAIRE

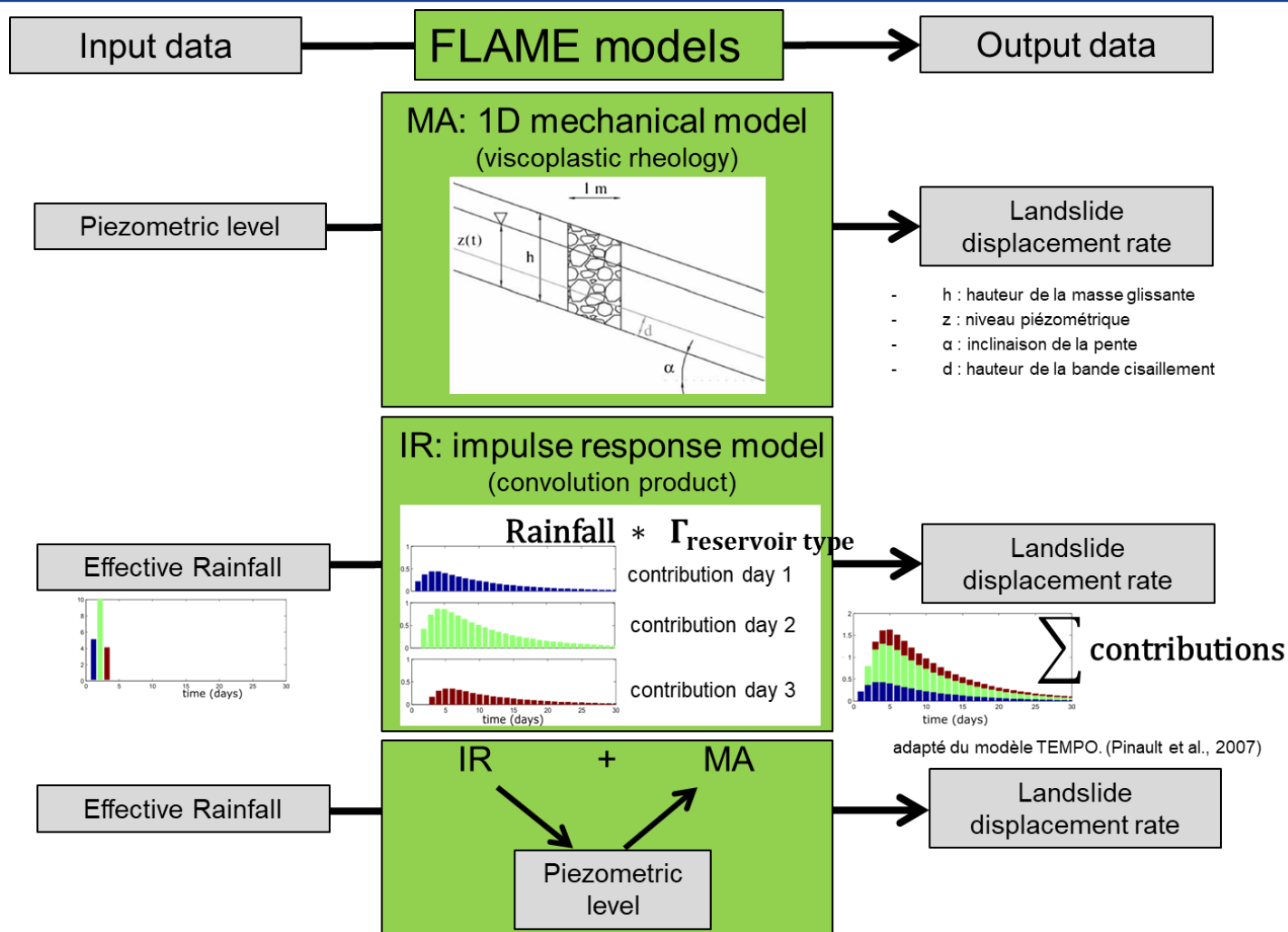
- Principe du modèle FLAME
- Modèle associé pour estimer la pluie effective
- Développements récents de FLAME

Forecasting Landslides Accelerations induced by Meteorological Events

Goal: real-time prediction of the landslide displacement rate



Forecasting Landslides Accelerations induced by Meteorological Events



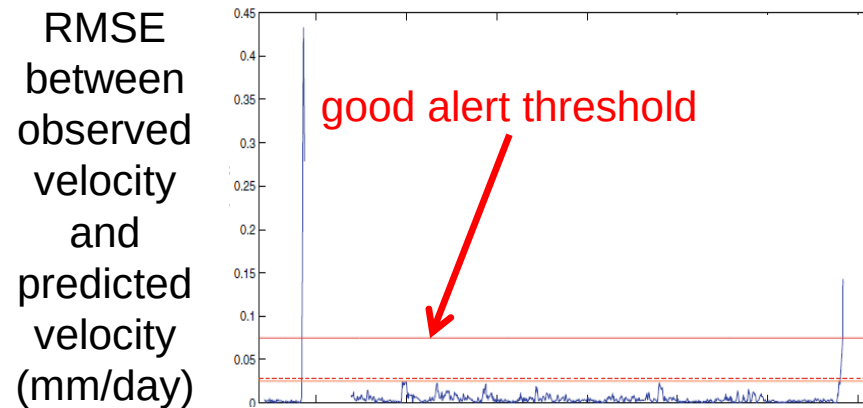
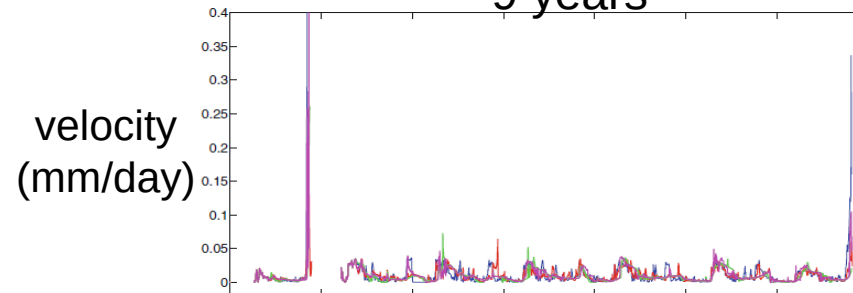
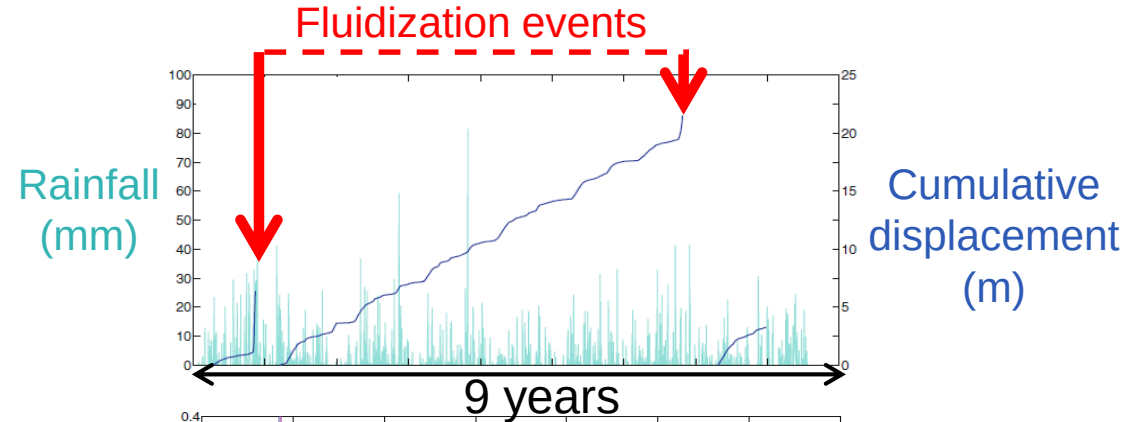
Forecasting Landslides Accelerations induced by Meteorological Events

1) optimization of the model parameters to minimize the difference between the estimated velocity and the observed velocity (inversion process) during a calibration period

2) prediction of the velocity using the FLAME models with the determined parameters



Super-Sauze mud flow



— Observed velocity
— IR Predicted velocity
— MA Predicted velocity
— IRMA predicted velocity

— RMSE Model IR
— statistical threshold: mean + 3 sigma
- - - statistical threshold: mean + 1 sigma
— distribution threshold: inflexion point

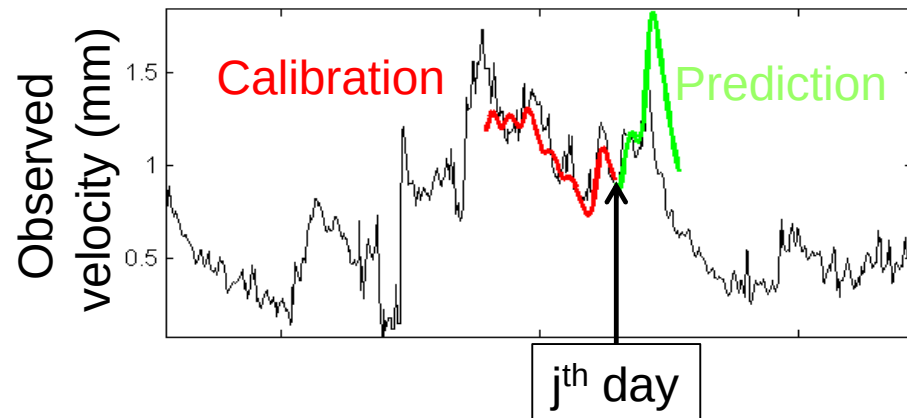
Forecasting Landslides Accelerations induced by Meteorological Events

Calibration: optimization of the model parameters to minimize the difference between the estimated velocity and the observed velocity (inversion process)

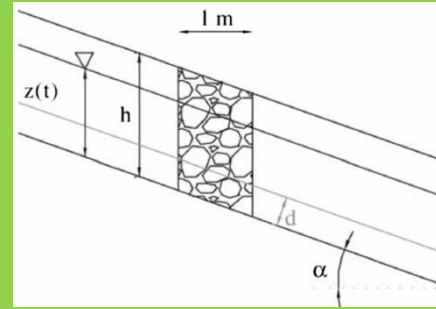
Criteria for optimization:

$$RMSE = \sqrt{\frac{1}{N} \cdot \sum_{n=1}^N (O(n) - M(n))^2}$$

O: observed velocity
M: modeled velocity
N: number of observations



MA: parameters h , d , η (viscosity), Φ (friction angle), ...



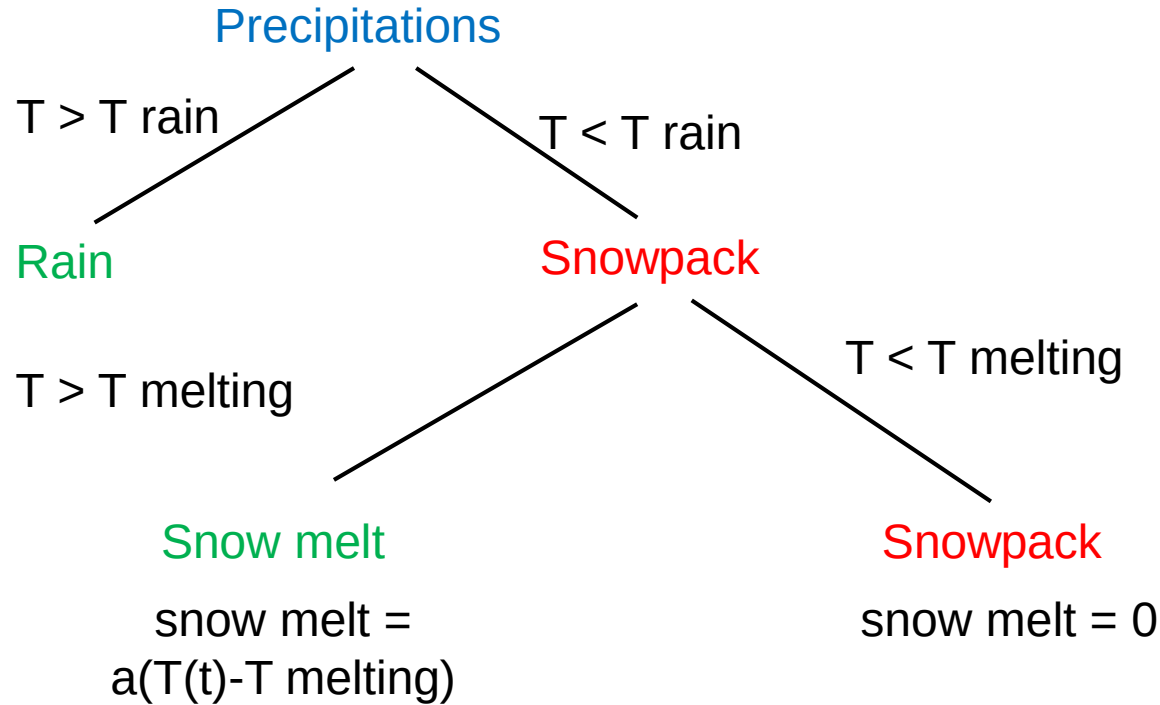
IR: parameters of the IR function T , D , L

$$\Gamma(t) = \exp\left(-\ln(2)\left(\frac{t-T}{D}\right)^2\right) * \exp\left(-t\frac{\ln(2)}{L}\right)$$

$\Gamma_{\text{reservoir type}}$

Prediction of the velocity using the FLAME models (MA, IR, IRMA) with the determined parameters

ASSOCIATED MODEL to estimate effective rainfall (= rain + snow melt)



NB: on this slide T =temperature, with T_{rain} and $T_{melting}$, threshold values to form snow and melt snow, respectively. On other slides, T is parameter of IR model

DEVELOPPEMENTS RECENTS DE FLAME

- inversion conjointe des données de 2 capteurs de déplacement
- début d'une interface utilisateur

Figure 1: FLAME

FLAME

Forecasting Landslide Acceleration induced by Meteorological Events

Choix du fichier .txt contenant les données GNSS

Parcourir

Choix du fichier .xlsx contenant les données météorologiques

Parcourir

Note: le fichier .xlsx doit contenir respectivement la date (format: 'dd/mm/yyyy'), la température (°C) et la pluviométrie (mm) avec un pas de 24 h.

Paramètres lissage

k_max	30
saut	30
Pas de lissage	1

Paramètres modèle neige

a	0.54
Tc	0.2
Tc1	-1
Tc2	0.4

Seuil RMSE 0.09

Note: le RMSE est défini en mm/jrs

RUN

Paramètres d'inversion

Note: les paramètres T, D et L sont en jours. Les valeurs doivent être cohérentes avec les observations de temps de réponses du glissement étudié

T	3	T2	3	alfa	0.8
T max	80	T2 max	80	alfa max	0.99
T min	0	T2 min	0	alfa min	0.05

L	3	L2	3	coeff	0.2
L max	60	L2 max	60	coeff max	10
L min	0	L2 min	0	coeff min	0.01

D	3	D2	3	gamma	0.1
D max	150	D2 max	150	gamma max	0.99
D min	0	D2 min	0	gamma min	0.05