FRIEND MED group– 4th International Workshop on Hydrological Extremes - Cosenza 15-17 September 2011




Parameter regionalisation of a distributed SCS rainfall runoff model : first results

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IRD Institut de recherche pour le développement

UM1 Université Montpellier 1

UM2 UNIVERSITÉ MONTPELLIER 2 SCIENCES ET TECHNIQUES

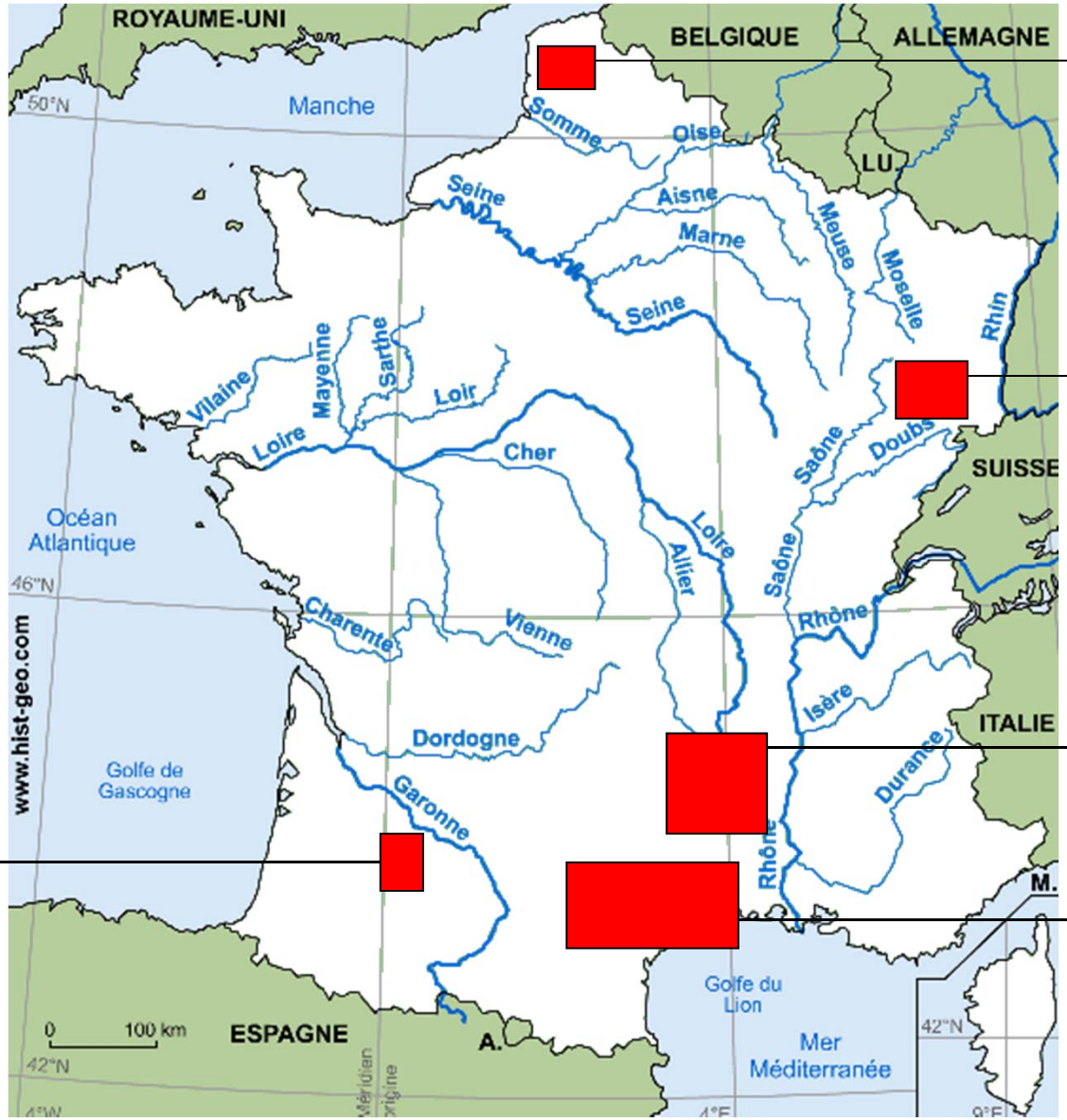
Context

- *Rainfall-runoff models are crucial tools for many hydrological applications : flood prediction or forecasting, impact of changes, water resources assessment…*

- *Still difficult (impossible ?) to perform models on ungauged catchments (in spite of valuable efforts !). (see Huang et al., 2007; Tramblay et al., 2010 in case of SCS)*

- *Need for regional syntesis → spatial variability of model parameters, which attributes, which relationship ?*

1. Location of the 17 catchments



Liane

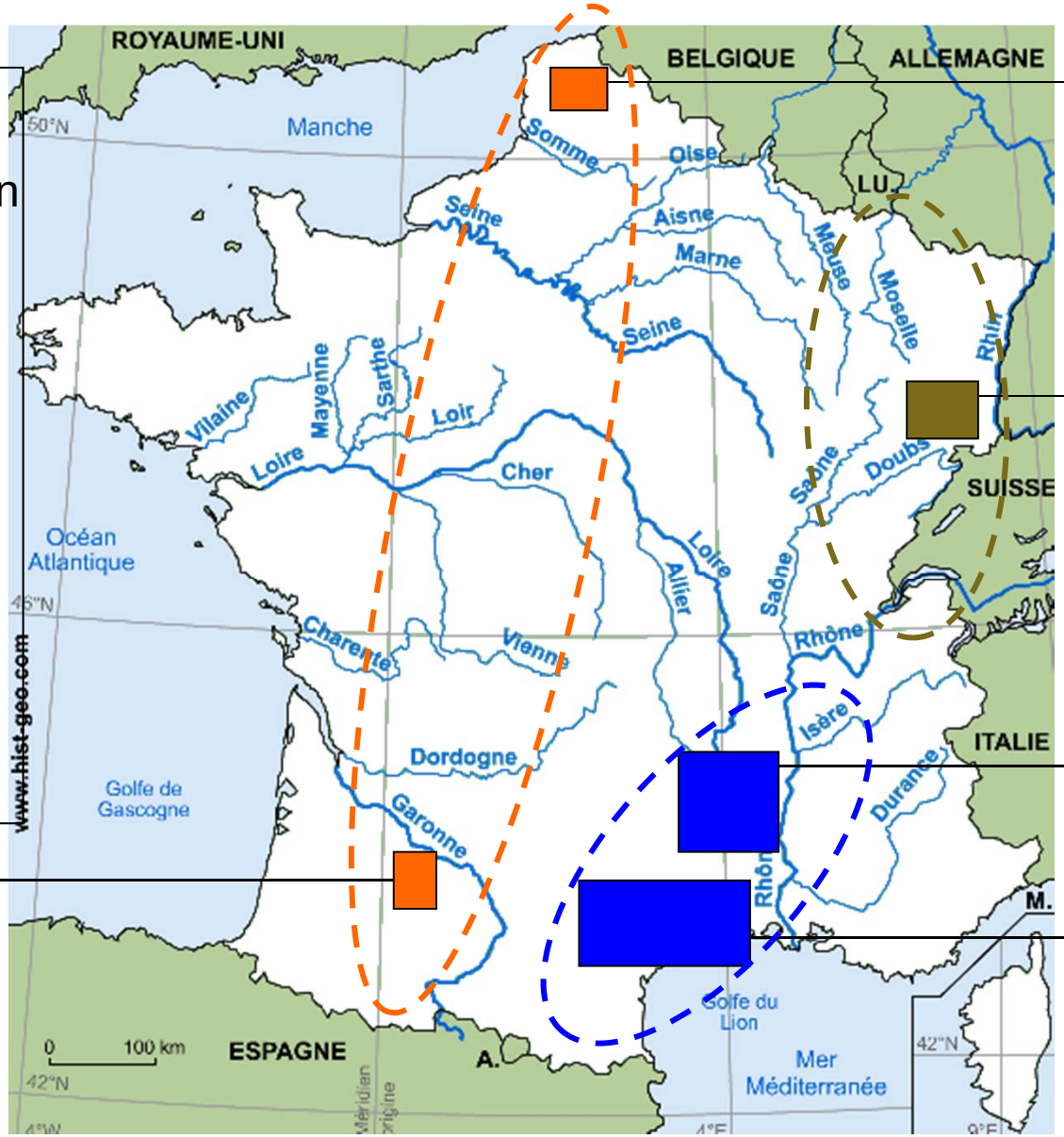
Savoureuse

Allier
Ardeche
Beaume
Gardon
Tarnon

Vidourle
Orbieu
Cesse
Verdouble

Touch

Climate



Mediterranean
P10~200mm

Oceanic
P10~50 mm

Continental
P10~50-100

Touch

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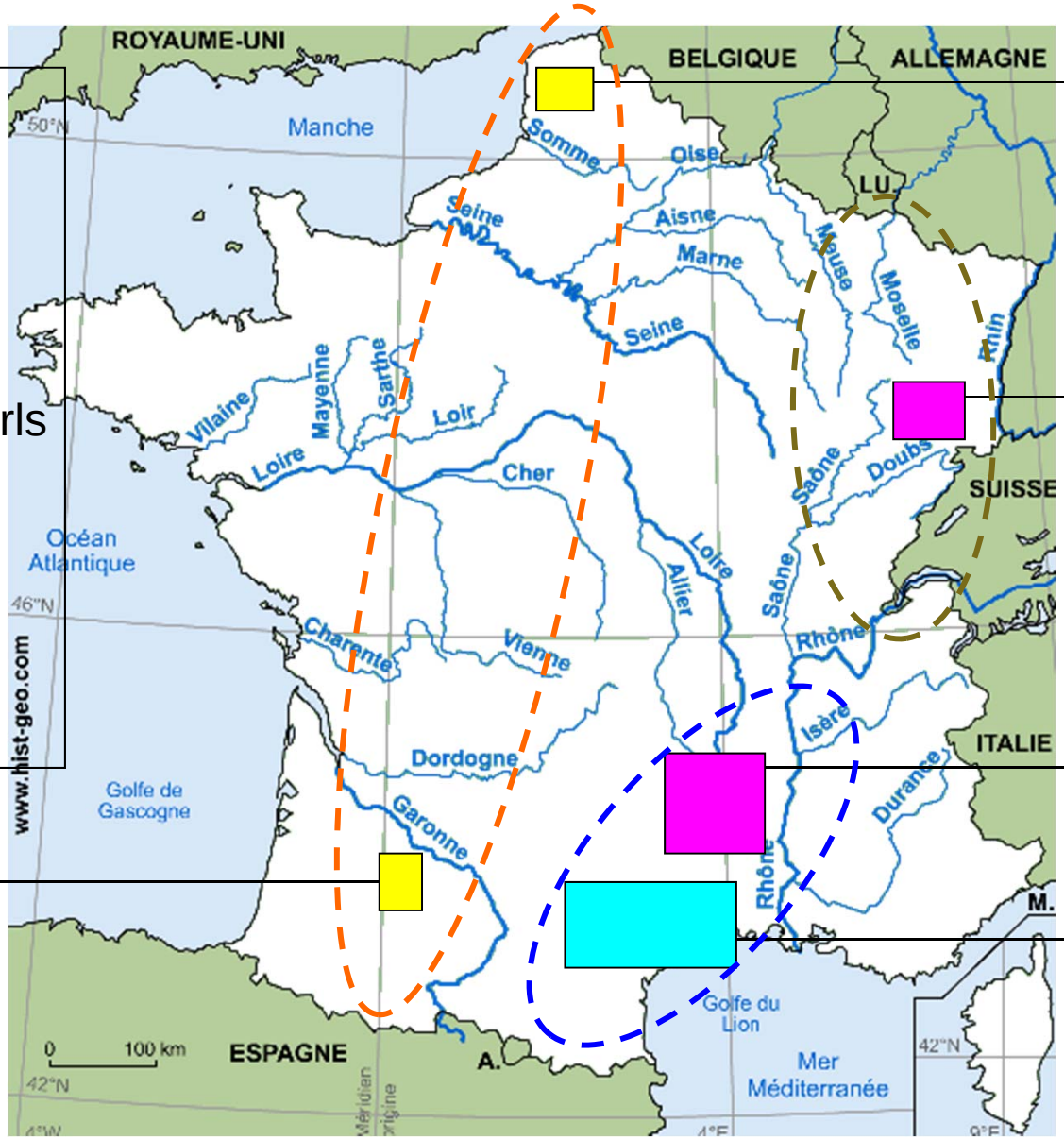
Vidourle
Orbieu
Cesse
Verdouble

SOILS

Granite, shale
sandy loam

Calcarious, marls
sandy clay

Clay
silty clay



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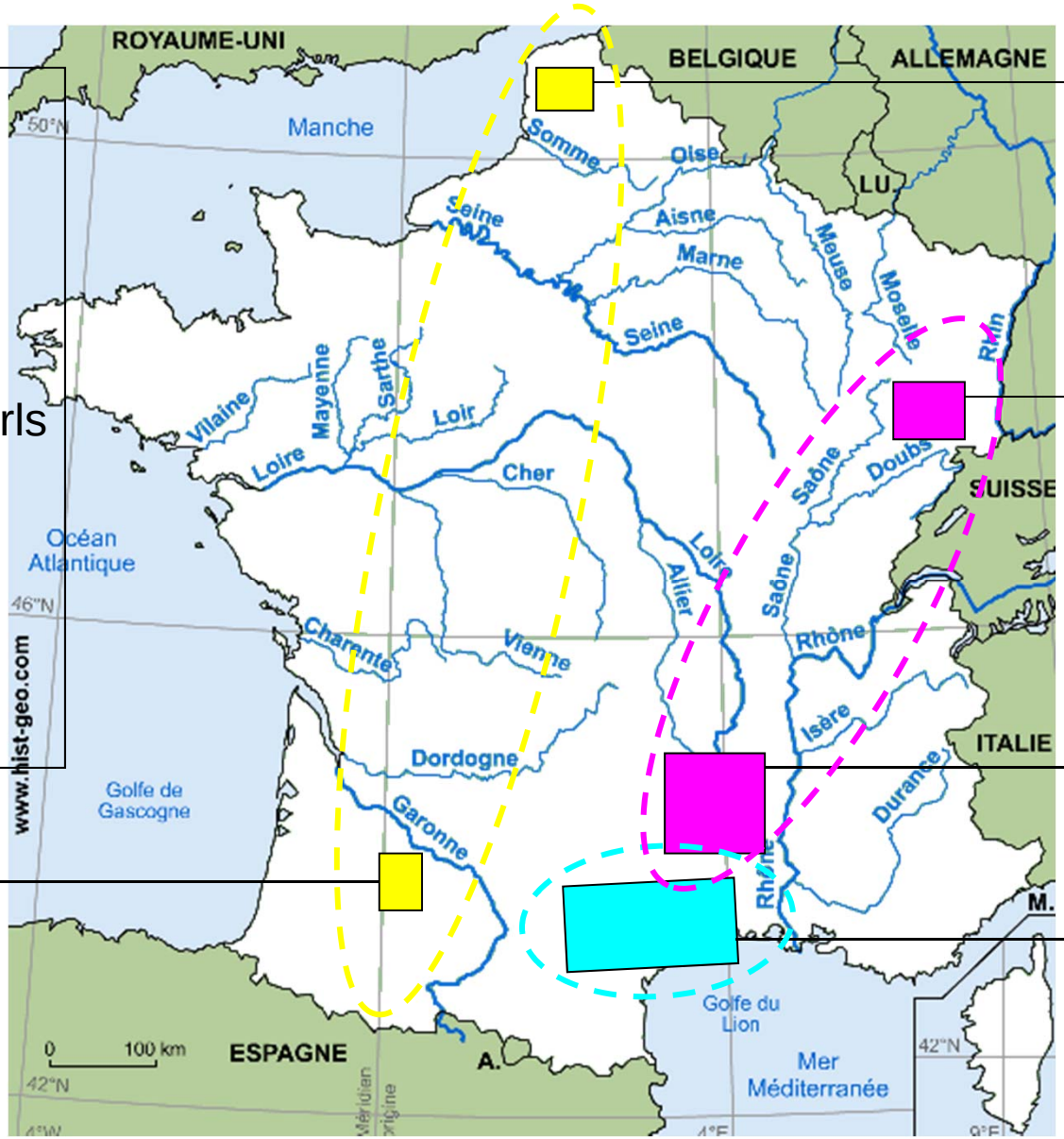

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Landscapes

Oceanic north

Oceanic south

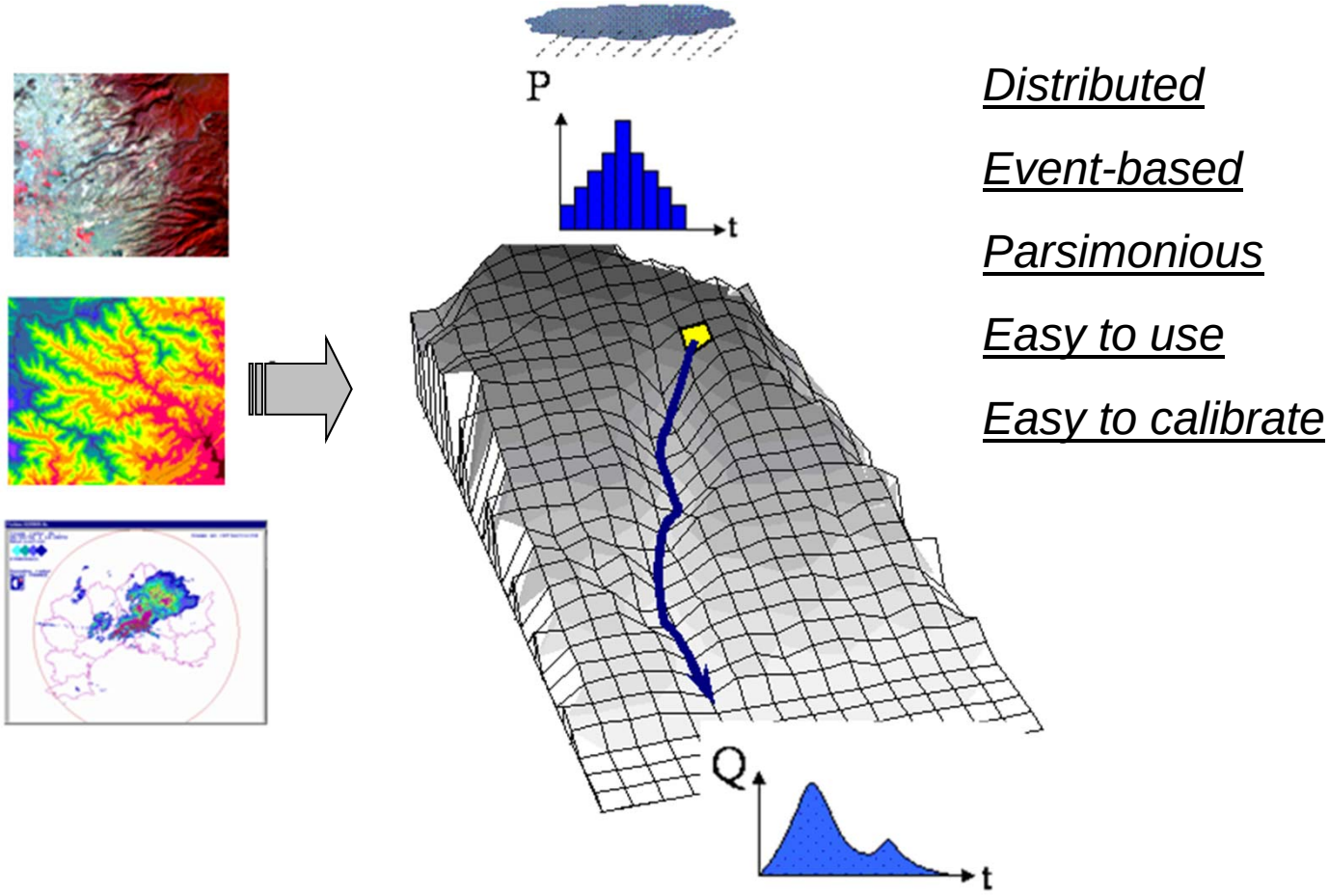
Mediterranean mountainous

Mediterranean plain

Classification

- 3 groups of climate
  méditerranéen/oceanic/continental
  dailyP_{10}=200/50/50 mm
- 3 groups of soils/geology
  sandyloam/clayloam/siltyclay
  Ksat = 200/50/10 mm/h
- Forest, pasture, shrub
- Little agricuture, no urban areas

2. SCS-LR distributed model



Distributed

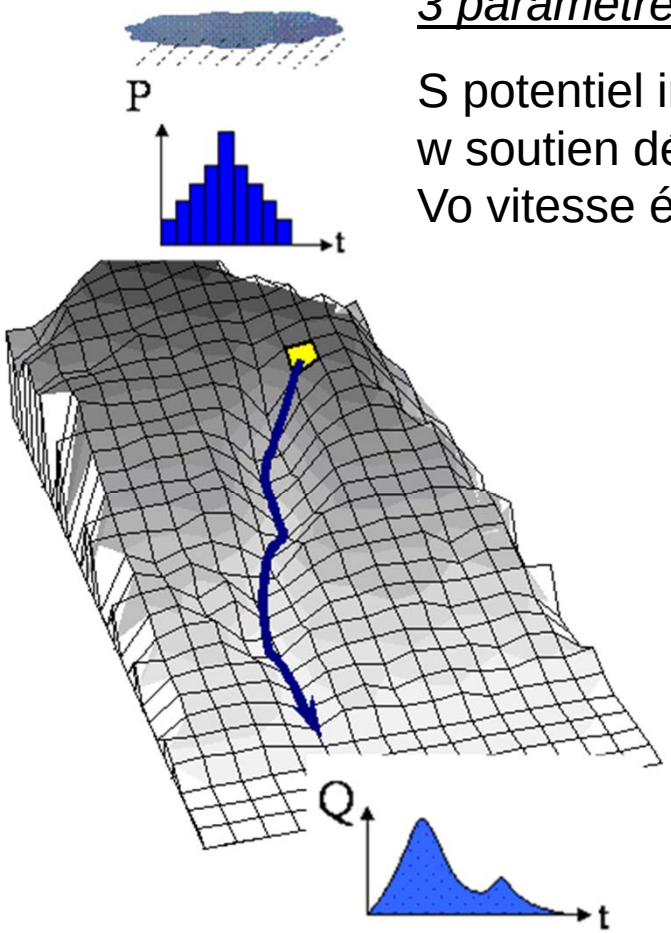
Event-based

Parsimonious

Easy to use

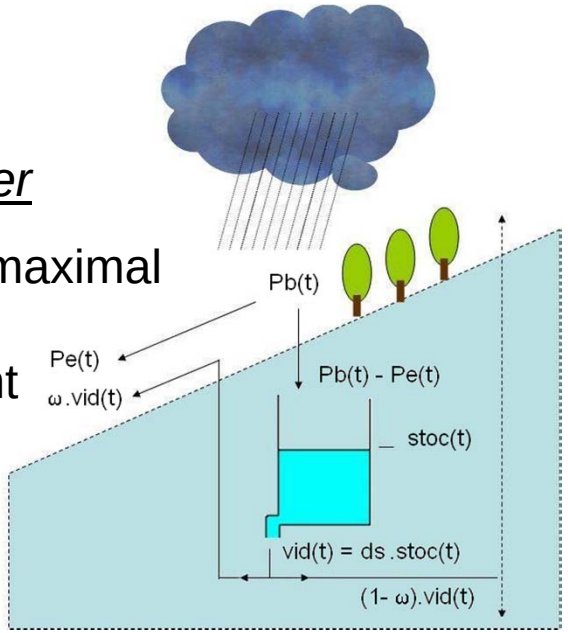
Easy to calibrate

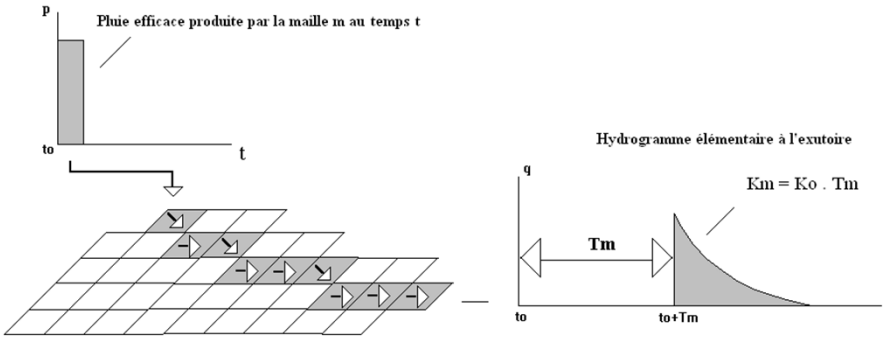
Modèle SCS-LR



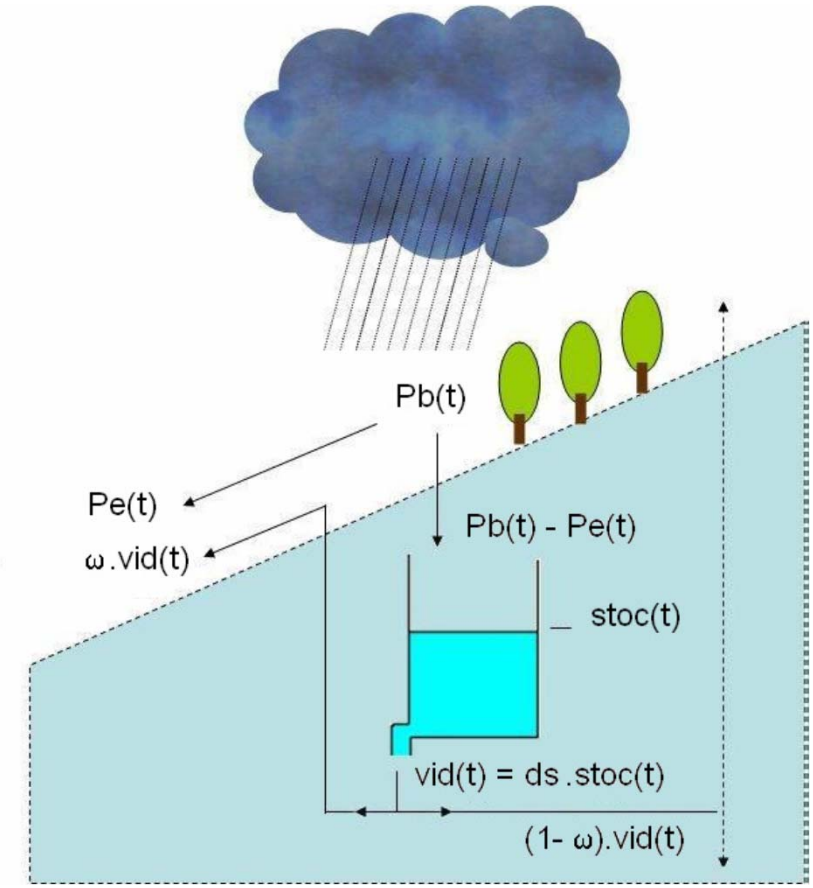
3 paramètres à calibrer

S potentiel infiltrable maximal
w soutien décrue
Vo vitesse écoulement





2. Adaptative SCS model



Adaptative SCS model, including surface runoff (same as classical SCS) and sub-surface runoff (innovative)

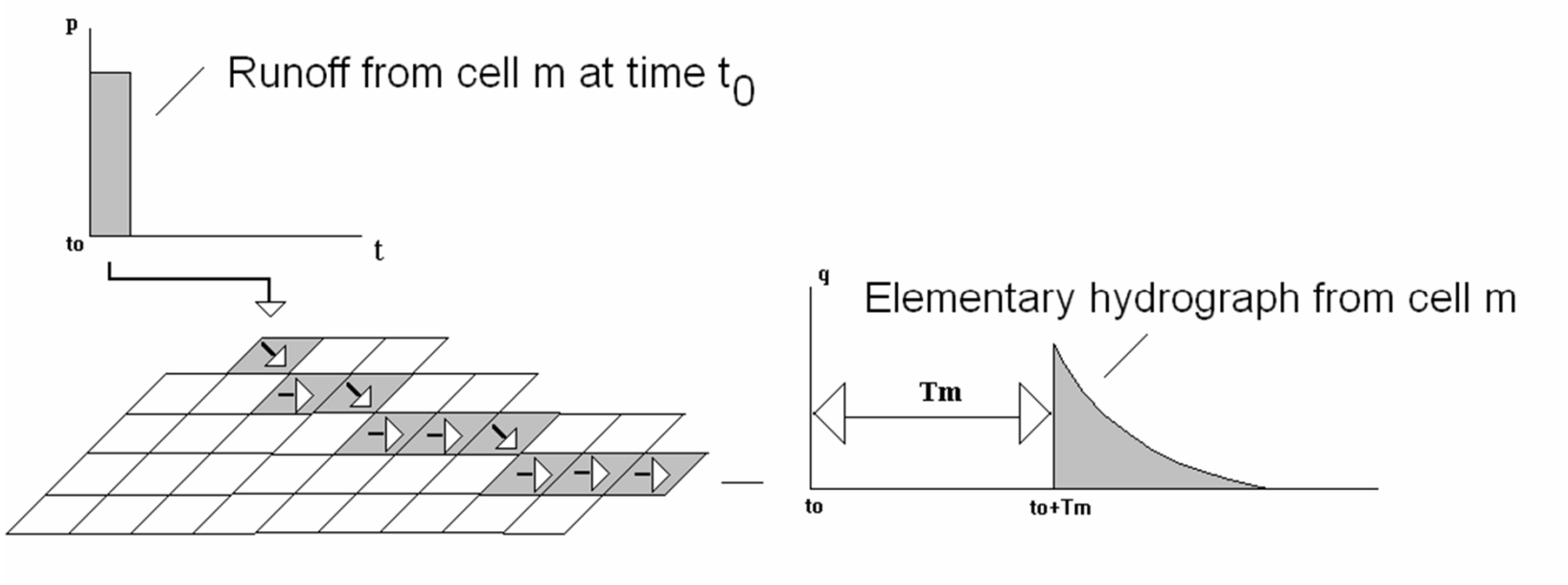
<u>3 parameters</u>

S = initial water deficit (~CN)

ds = discharge of soil reservoir

w = part of the discharge as sub-surface runoff

2. Lag and Route model



2 parameters

Vo routing velocity

Ko diffusion coefficient

http://www.athys-soft.org/ - Microsoft Internet Explorer

Fichier Edition Affichage Favoris Outils ?

Précédente Suivante Arrêter Actualiser Démarrage Rechercher Favoris Historique Courrier Imprimer Edition Dell Home Real.com

Adresse http://www.athys-soft.org/ OK Liens

ATHYS

Atelier hydrologique spatialisé

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Données hydro-climatiques
Exemple de session
Plus d'informations

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Fonctions principales
Visualisation des données
Opérations sur les données
Plus d'informations

VICAIR

Fonctions principales
Visualisation des images
Opérations sur images
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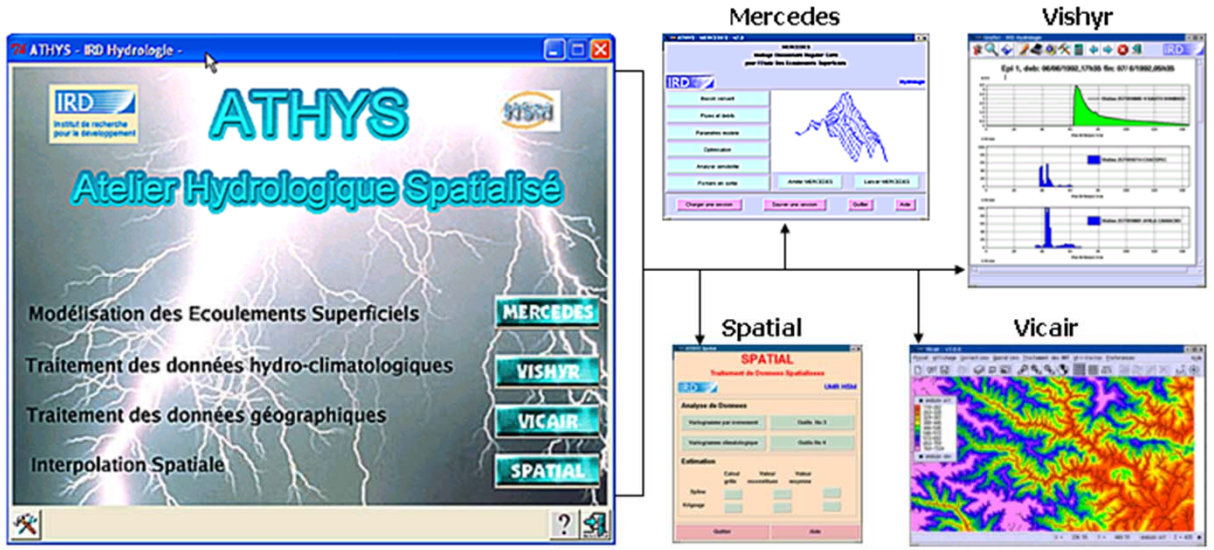
ATHYS Atelier Hydrologique Spatialisé

L'ATelier HYdrologique Spatialisé, ATHYS, a pour objectif de réunir dans un environnement convivial et homogène un ensemble de modèles hydrologiques associés à des traitements de données hydro-climatiques et géographiques. Il a été développé à l'IRD pour des applications diverses : gestion de la ressource en eau, prévision des événements extrêmes, études d'impact liées à des modifications anthropiques ou climatiques.



Internet

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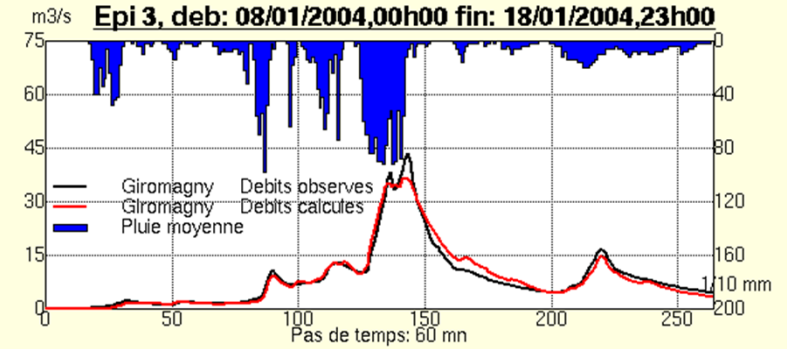
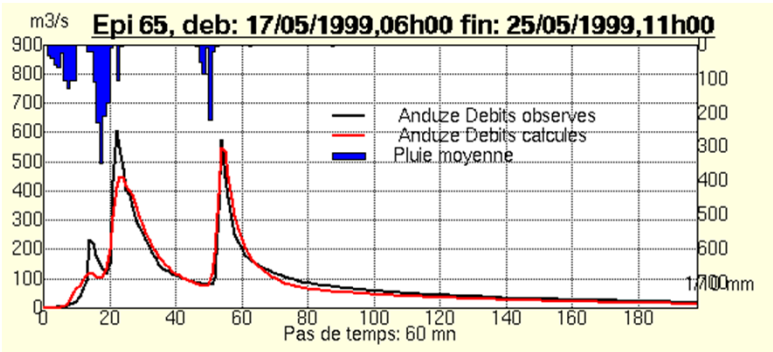
2. SCS-LR distributed model

- Calibration : 15 floods/catchment, time 1h



Savoureuse at Giromagny
S = 144 mm, w = 0.64, ds = 0.4 j-1, Vo = 1.5 m.s-1, Ko = 2, Nash =0.95

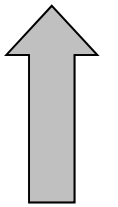


Gardon at Anduze
S = 148 mm, w = 0.51 , ds = 0.4 j-1 , Vo = 2.63 m.s-1, Ko = 2, Nash =0.92

Mean Nash between 0.59 and 0.88

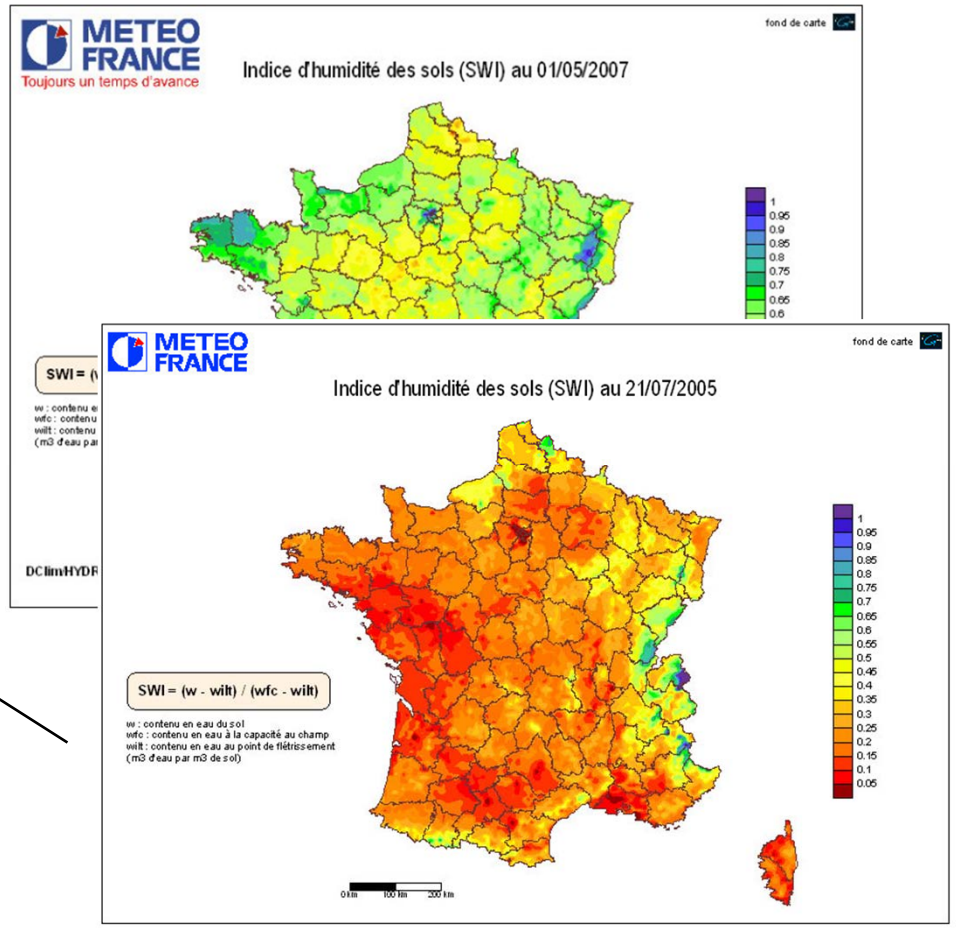
Initial condition of the model

Initial water deficit S



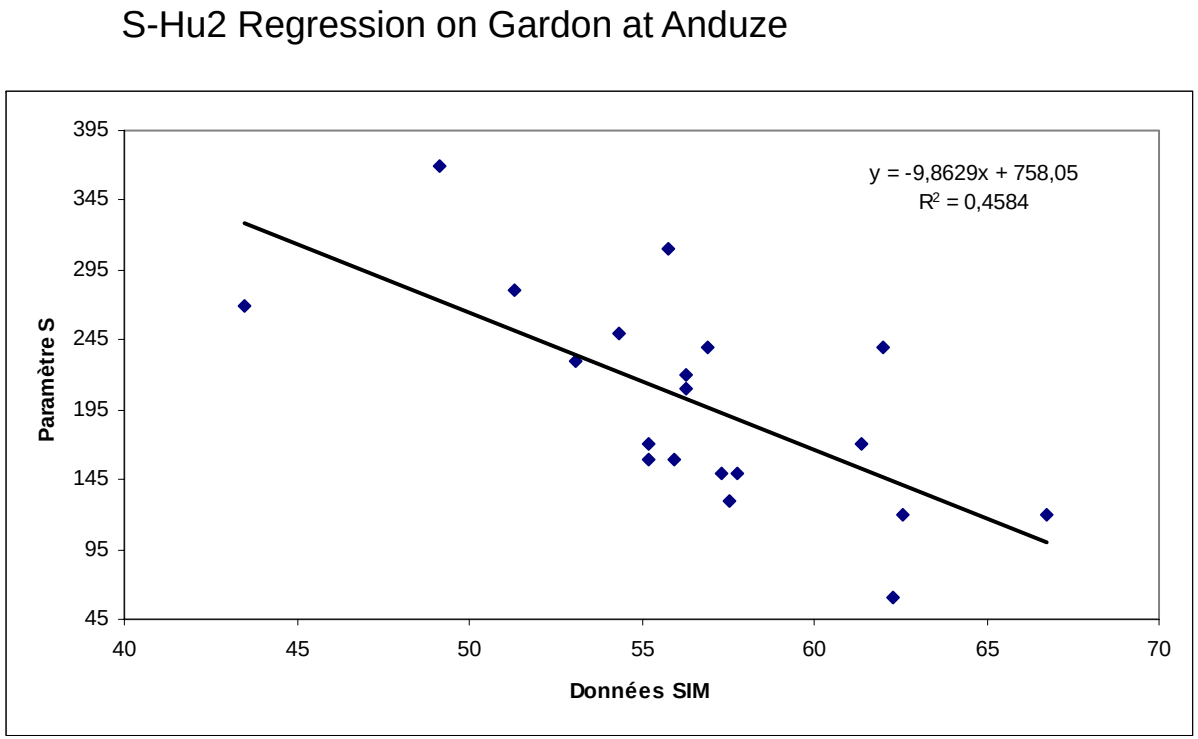
Hu2

daily at 6 TU
8x8 km2 pixel
output of ISBA model
3 layers : surface, root, deep



SIM Model Meteo-France

S-Hu2 relationship

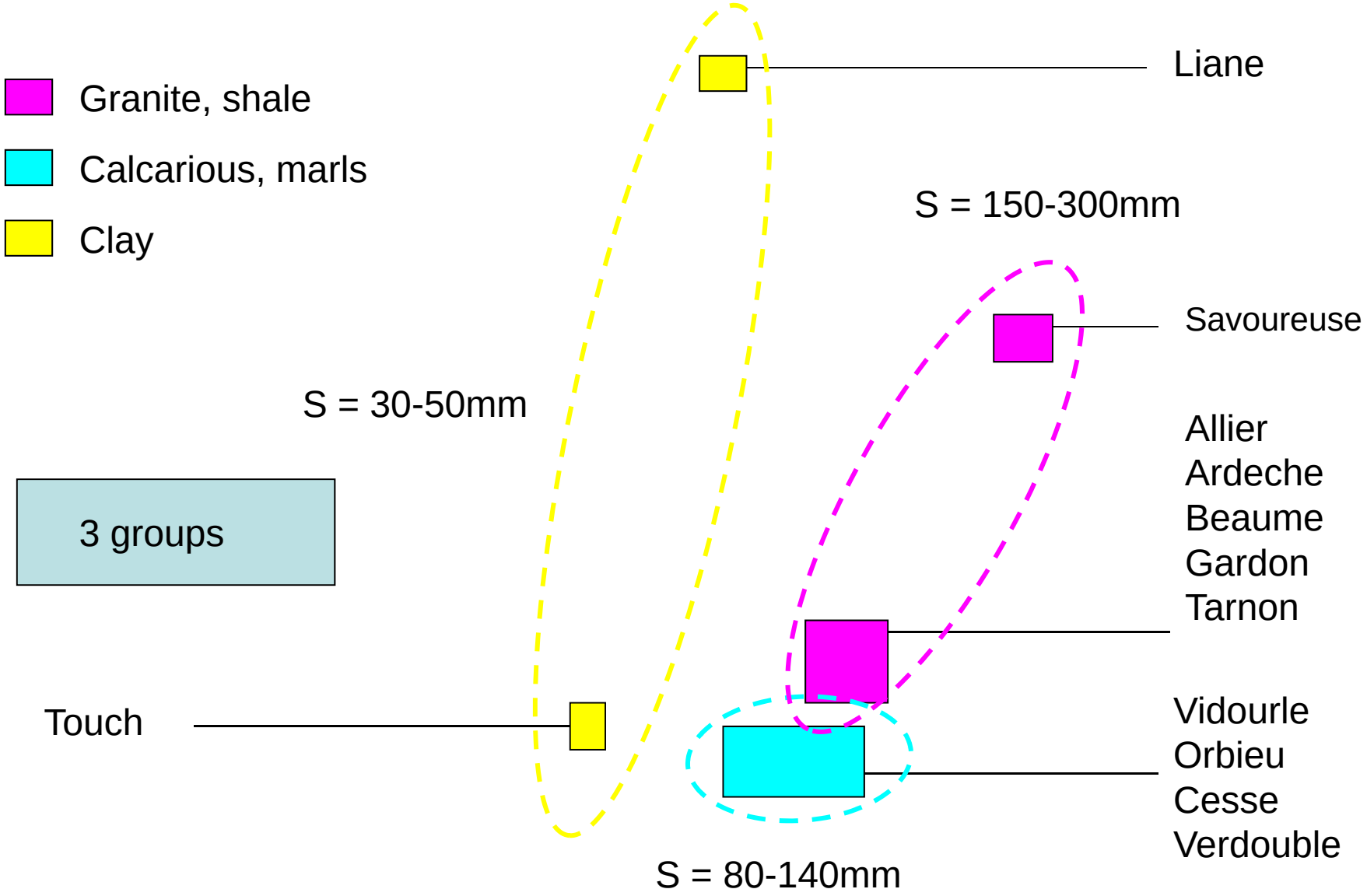


R^2 ~ 0.5 pour les bv med, << pour les autres bv

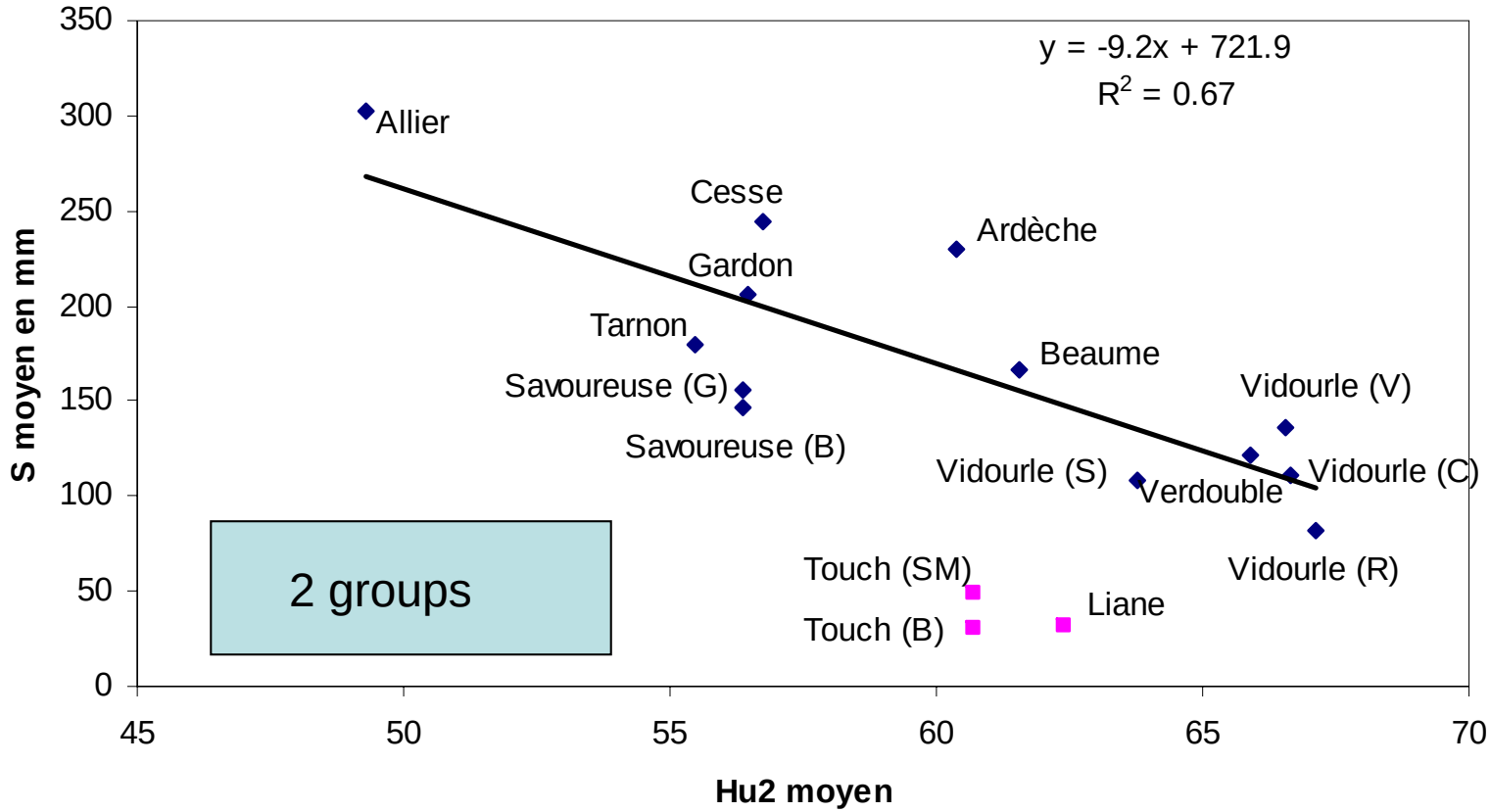
3. Parameters regionalization

- Focus on the main parameters
  S initial water deficit (~CN)
  Vo routing velocity
- How do these parameters change from one catchment to another : climate, soils, slopes …. ?
- How does S parameter change from one event to another ?

S median / Soils

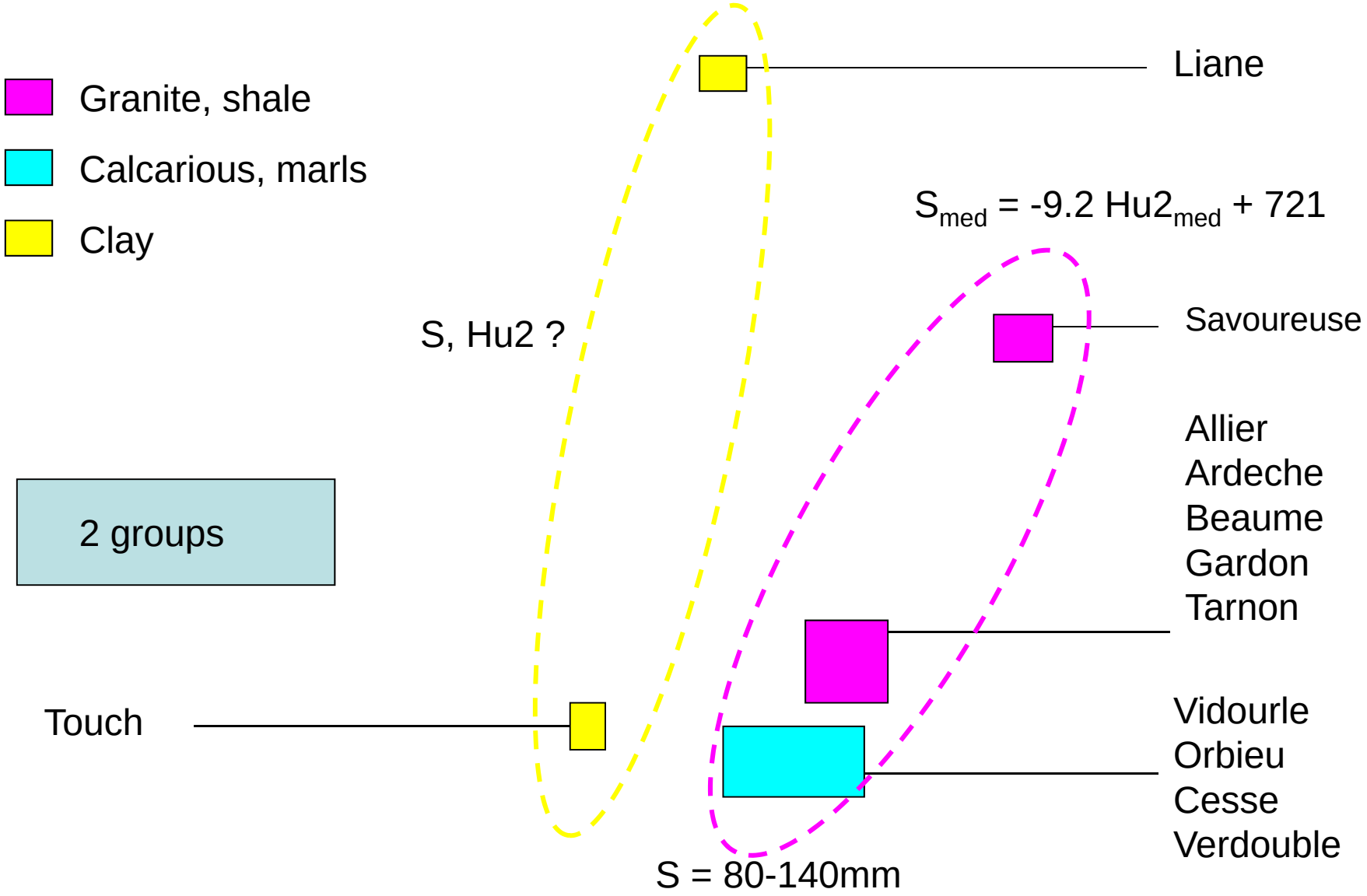


S median / Hu2 median



Hu2 integrates soils, rainfalls & climate – more efficient than soils

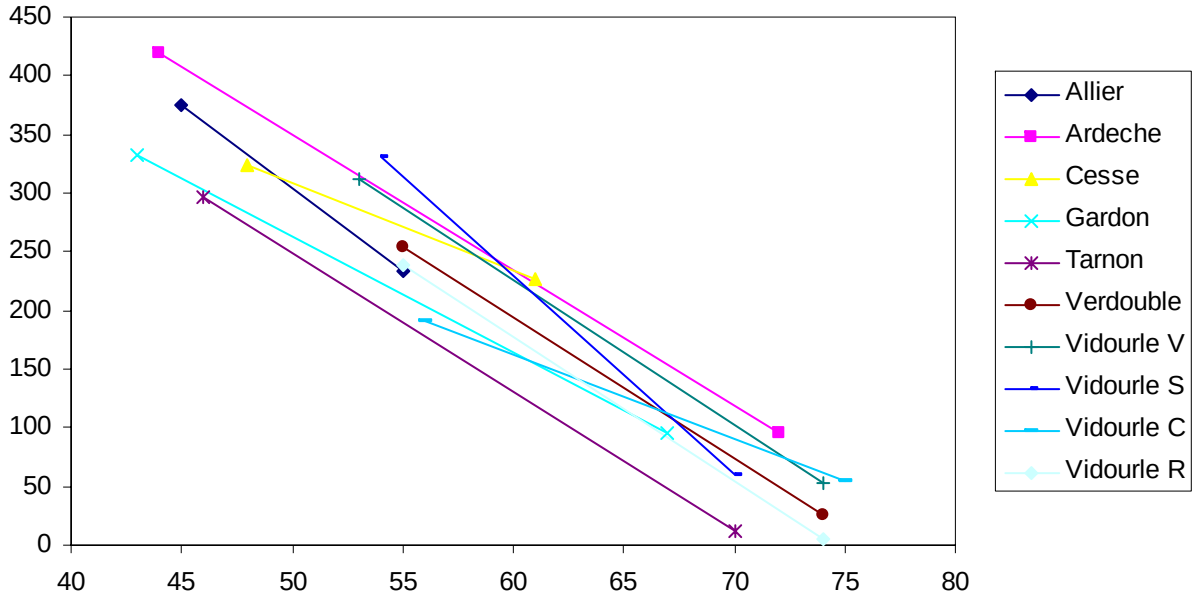
S median / Hu2 median



Regional event-scale S-Hu2

- Bassins méditerranéens

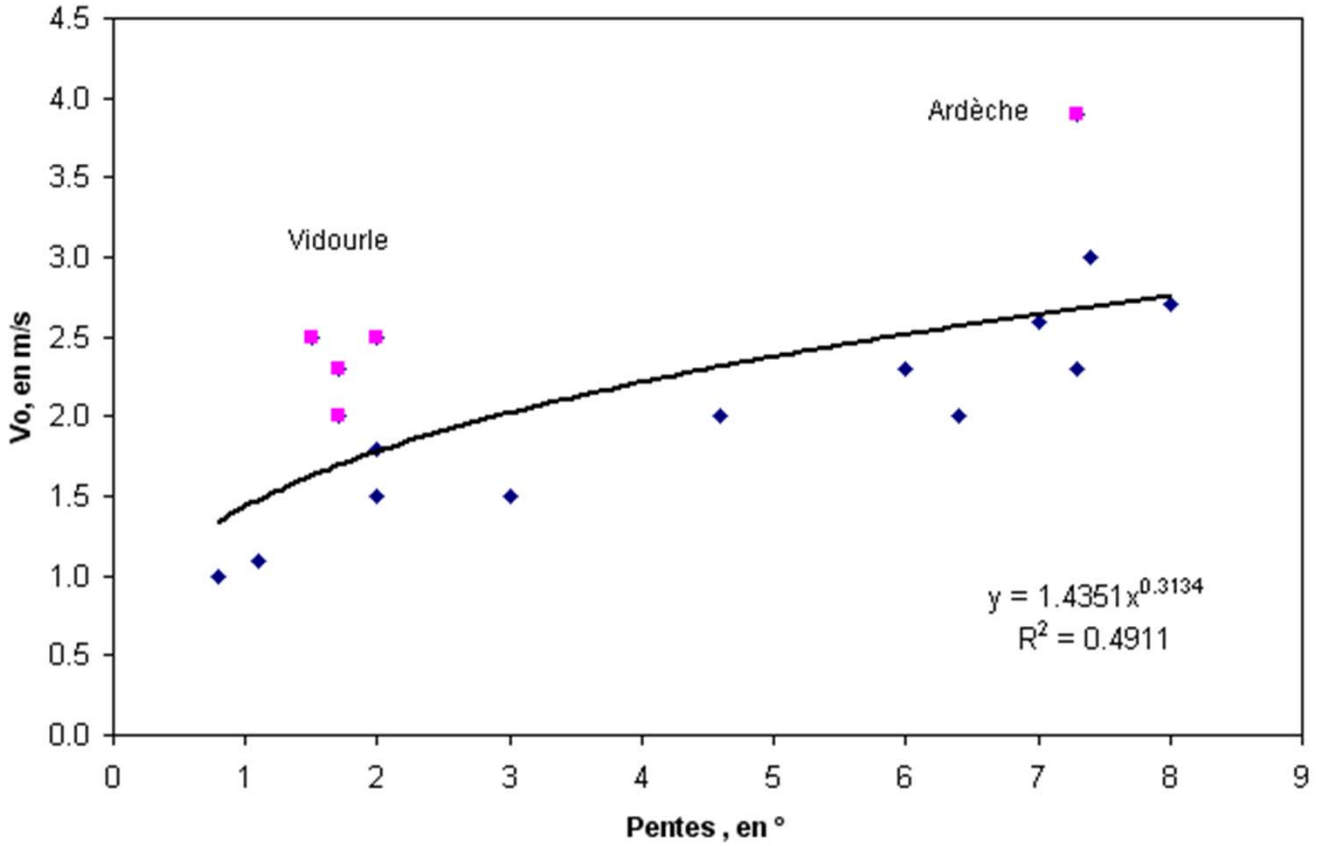
S = -11.7 Hu2 + 900



Regional Vo Relationship

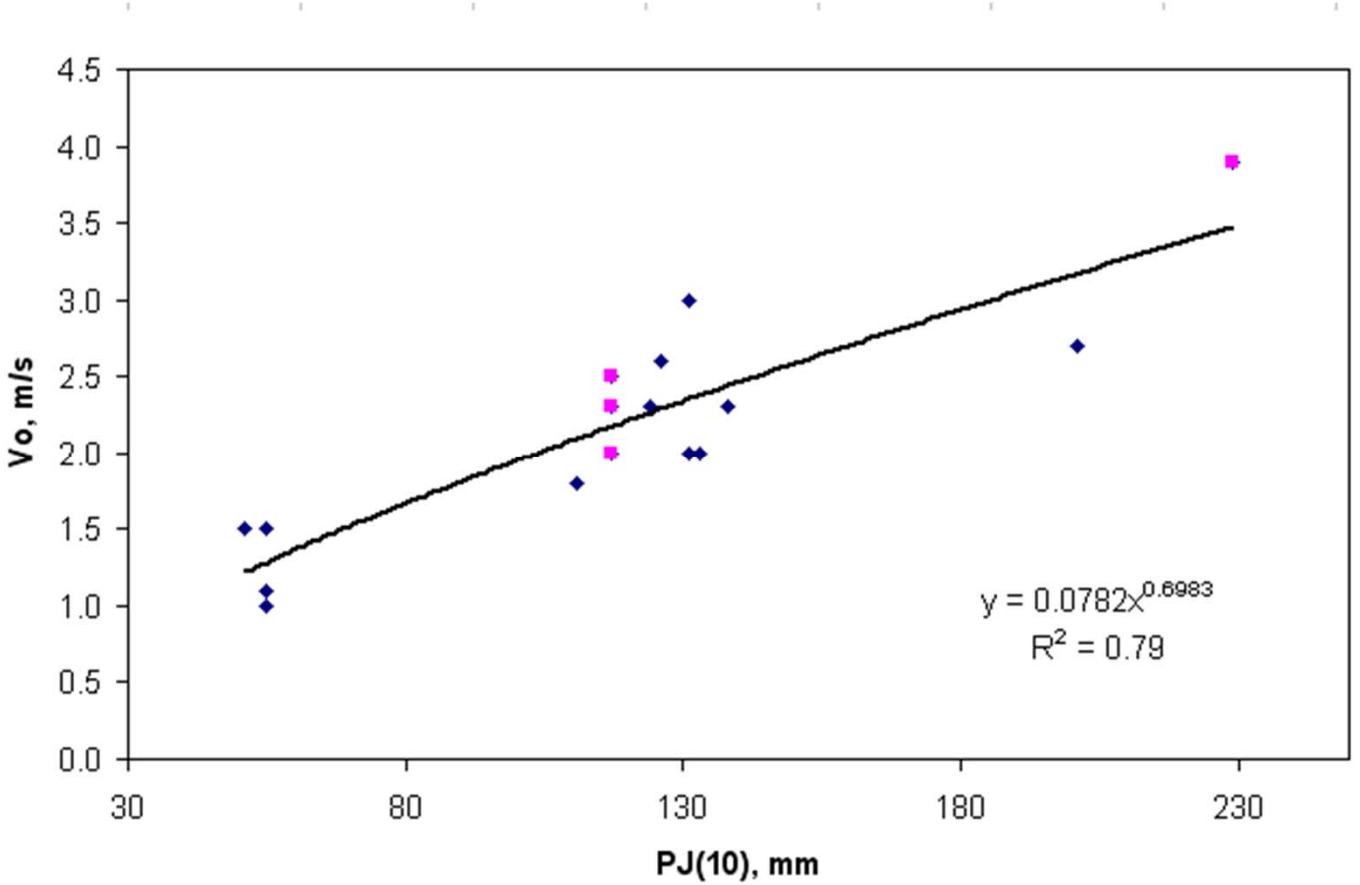
Vo = mean velocity

- Vo vs network slope



Regional Vo relationship

- Vo versus daily 10-years rainfall (as index of potential runoff)



Conclusions

- Runoff : soil wetness index Hu2 efficient; integrates previous rainfall, soil, vegetation
- Routing : more hydraulicity than slope; 10-years daily rainfall efficient
- Model matches all the catchments, but runoff Hu2 index only Med-catchments
- Expand with new catchments