Estimating Crop Residue Cover by Remote Sensing using the visible/near infrared bands

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Objective

- Monitoring of surfaces potentially contributing to runoff in an agricultural context
- Excessive runoff and soil erosion

⇒ Monitoring tools are required
Project historic and support

> FLOODGEN (ENVA CT96 0368) European project (1997-2000)
  • Supply agricultural land managers with observation and simulation tools for studying the hydrological effects induced by agricultural practices
  • Based on satellite earth observation, GIS and runoff modelling methods
  • applied at the scale of the catchment basins

> The present study
  • Supported by BRGM, CNES, and two national programs: PNTS and PNRH.
  • ESA provided the ASAR images under Project No. 351 ENVISAT/ASAR. The SPOT images were obtained through the ISIS program of the CNES.

Service ARN
March 2005
As residue cover improves infiltration and soil aggregation, the mapping of residue cover states could offer a reliable key for assessing which surfaces can potentially contribute to runoff in agricultural contexts: optical sensors.

Soil roughness plays the role of trapping water which helps infiltration and reduces downstream runoff: In loamy context: smooth soil has a poor infiltration capacity comparatively to a rough soil: radar sensors.
Results

Soil infiltration capacity decreases according to cumulative rainfall

- Initial fragmentary structure
- Fragmentary state with structural crusts
- Continuous state with depositional crusts

Cumulative rainfall (mm)

Infiltration capacity (mm/h)

Smooth area

Rough area
Results

Use of SAR data for monitoring surfaces potentially contributing to runoff in an agricultural context

LANDSAT TM February 98

RADARSAT (47°) February 98

Areas contributing to runoff in winter (47%)

Retrieval of surface roughness of bare soils

High runoff potential (18%)
Moderate runoff potential (25%)
Low runoff potential (4%)
Other

Retrieval of areas contributing to runoff - bare soils
Use of Chris-Proba data

> Objectives:
  • to determine the spectral reflectance of crop residues and soils
  • to assess the limits of discrimination that can be expected in mixed scenes

By
  • Evaluating the spectral reflectance of crop residue via the CHRIS hyperspectral sensor
  • Determining the threshold for detection of near-surface soil characteristics under variable residue cover

the potential of radar is studied for the retrieval of physical parameters describing the soil surface (surface roughness and soil moisture)
Study sites

> Two study sites in France:
  Toulouse
  Strasbourg

> Data acquisition
  • Chris Proba data
  • ASAR data
  • Ground measurements:
    - Roughness profiles
    - Soil moisture
    - Crop residues
    - Soil characteristics
CHRIS request for acquisition in 2005

Touch Basin (Toulouse)
• 12 images: one image per month for one year
• Field work is scheduled from end of March 2005
• mode 1 and mode 3 will alternate each month

Landser basin (Strasbourg)
• 8 images: one image per month from April 2005 to November 2005
• mode 1 and mode 3 will alternate each month