PROBA CHRIS contribution to the BACCHUS precision farming investigation

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3rd ESA CHRIS/Proba Workshop
BACCHUS is a Research and Technological Development Project co-funded by the European Commission under contract number EVG1-CT-2002-00075, within the 5th Framework Programme and its subprogramme ‘Energy, Environment and Sustainable Development’

Main objective:
To provide a methodological approach for vineyard inventory and management with an integrated and comprehensive solution to meet their information requirements, based on the use of ...
The “Bacchus” Project

- Geographical Information Systems
- High Resolution Remote Sensing
- Very High Resolution Remote Sensing
- Modern software programming languages
Frascati DOC area

Frascati DOC is of about 1700 ha
Within an area of about 8000 ha
Frascati community wine parcels, 1402 wine parcels - 33.2% DOC area
621.2 ha - 34.8% DOC area
SAR processing

Objective: Analysis of backscattering behaviour of vineyards through time

Images selection

Significant number of acquisitions taken during maturation period
Suitable baselines to allow very precise coregistration

1999: 9 images (ERS1-2)
2001: 8 images (ERS-2)

Coregistration and processing by means of the tool “BEST”

Basic Envisat SAR Toolbox v.4.02

Co-Registration
Complex to Amplitude
Amplitude to Power
ADC – Compensation
Backscattering Image Generation
Porting into the “Bacchus” Project
Control of co-registration procedures
Ground-truth collection

- Grapes phenology
- Working records
- Production records

Vineyard history is basically retrieved
Correlation between backscattering and production

During summer time (when soil is no artificially modified) correlation between remotely sensed data and production seems to be feasible.

$\Delta\sigma^0$

$\text{Biomassa [q/He]}$

$y = 135.06x$
$R^2 = 0.6689$

$y = 129.26x$
$R^2 = 0.5462$

$y = 133.38x$
$R^2 = 0.3874$

$y = 142.09x$
$y = 138.63x$

Confronto biomassa 1999 - 2001

Vendemmia iniziata

Biomassa nel 1999 - 2001
$y = 133.38x$
$R^2 = 0.3874$


Biomassa nel 1999 - 2001
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Vendemmia iniziata
Phenology and climatology

• Key person: Dr Maurizio Severini (CNR ISAC)

• Objective:
  – to estimate optimal harvest time for specific Frascati subregions
Good news for wine industry

Global warming decreased the number of winter frosts, increased and stabilized wine quality.

(from Sotheby’s Auction House)

“Climatic changes over coastal California from 1951 to 1997 may have benefited the premium wine industry, as seen in higher quality wines and larger grape yields.” Nemani et al., Clim. Res., 19/2001

- ISAC
What about Frascati?

Good news also for Frascati D.O.C. wine

Global warming

increased and stabilized wine quality

(decreased the number of winter frosts)

(from HARRIS’ WINE VINTAGE CHARTS)
and what about life-cycles of grapevines and their pests in a temperature increasing scenario in the Frascati D.O.C. area?

- ISAC
To answer the questions a computer model was built up that correctly describes the present situation and foresees the future one.
Model name is “Delay Simulator” DS

its forcing variable is temperature

its parameters depend on plant/parasite physiological characteristics

- ISAC
Results: grapevine phenology

Present, year 2000:
- bud break
- flowering
- veraison
- maturation: 18 days anticipation and shorter duration

Future, year 2050:
- bud break
- flowering
- veraison
- maturation:

Future:
- annual cycle anticipation
- phenophases anticipation
- vintage anticipation
Results: parasite phenology

Future:

larval stages anticipation

fourth generation cannot develop (because of grapevine annual cycle end)
New integrated data: Proba

• PROBA CHRIS
  – an ESA flexible hyperspectral instrument
  – 18 bands @ 18 m resolution
    • Definition of specific “vegetation indexes” for monitoring phenology
    • Analysis correlation with production estimates
  – Proposal submitted by Uni Roma Tor Vergata for some 20-30 images in 2004-5
New related projects

• Frascati DOC site and e-collaboration
  – Integration of technologies for virtual organisations
  – Funded by ESA, Agriculture/Forest community is one of the supported demonstration

• Vines in space
  – Italian vine experiment on next mission (April 2005) to International Space Station
  – Scientific activity to be started for the evaluation of the vines properties back from space