2nd MERIS/(A)ATSR User Workshop
22nd to 26th September 2008 ESA/ESRIN Frascati
(Rome) Italy

Supervised Crop Classification from Middle-resolution Multitemporal Images

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INTRODUCTION

Land Use mapping – focus on agricultural land

- Crop classification: input to other modelling systems

Characteristics:

- Dynamic changes (1 year period, crops phenology)
- High temporal resolution data needed
- Monitoring at national level – large coverage of images (MR)
- Vegetation: multispectral data (VIS - NIR)
- Agricultural landscape structure: large fields (avg. 12, up to 300 ha)

Middle resolution, multispectral, multitemporal data = MERIS

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INTRODUCTION

Objectives

- Crop classification at pixel level from MERIS data (300 m)
- Test on possible crops / crop groups discrimination

- Validation against independent HR data classification

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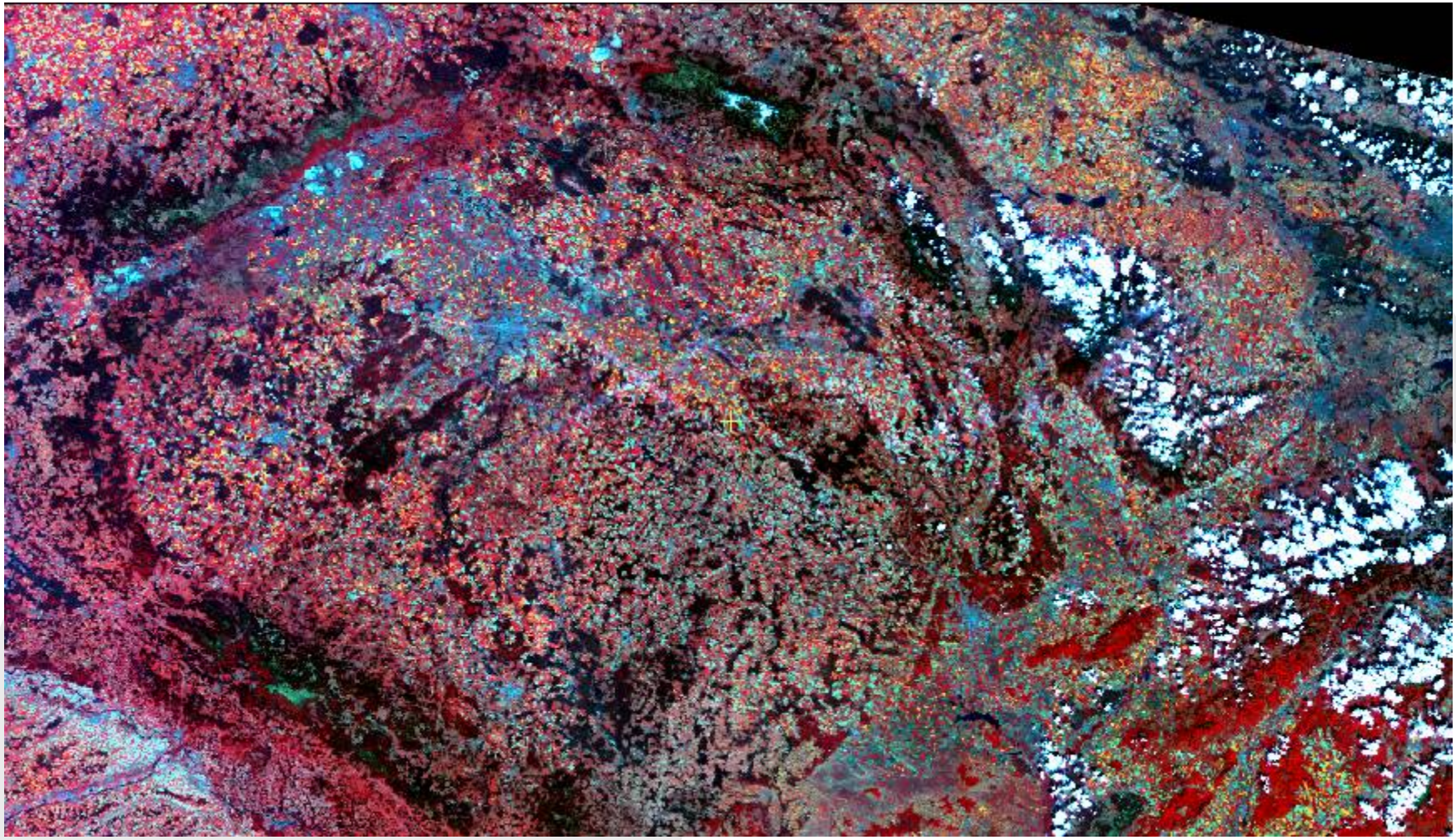
MATERIALS AND METHODS



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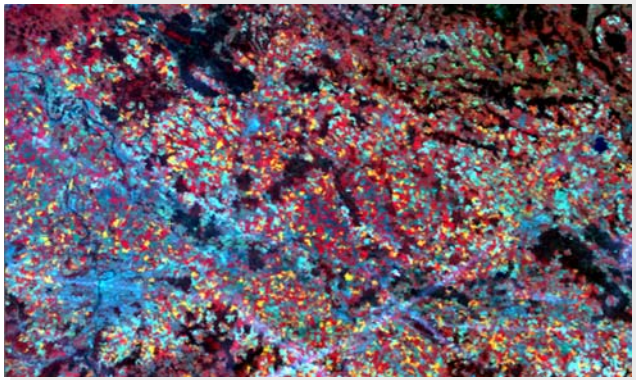
MATERIALS

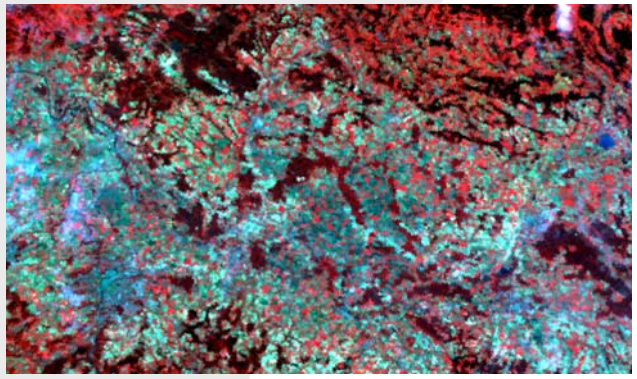
Data – time series

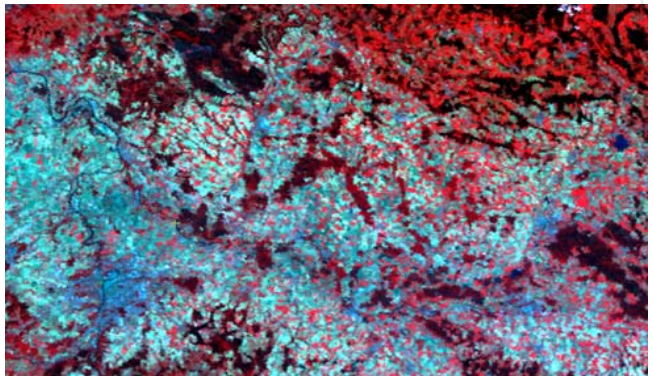
Limitation: cloud cover during main vegetation period!

June: NO image!

Spring1 (April):
MER_FRS_1PNPDE20070420
MER_FRS_1PNPDE20070423
MER_FRS_1PNPDE20070426
Spring2 (May):
MER_FRS_1PNPDE20070503
Summer1 (June/July):
MER_FRS_1PNPDE20070719
Summer2 (August):
MER_FRS_1PNPDE20070806
MER_FRS_1PNPDE20070807
MER_FRS_1PNPDE20070813
Autumn1 (September):
MER_FRS_1PNPDE20070916
MER_FRS_1PNPDE20070917
MER_FRS_1PNPDE20070923
MER_FRS_1PNPDE20070930







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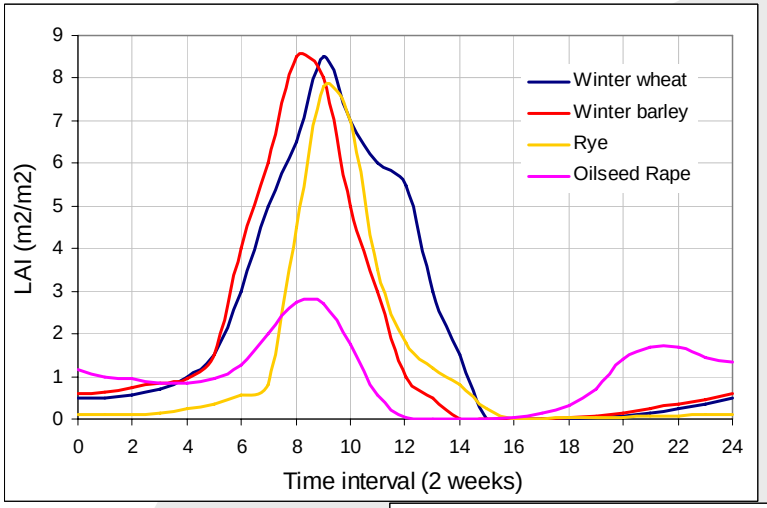
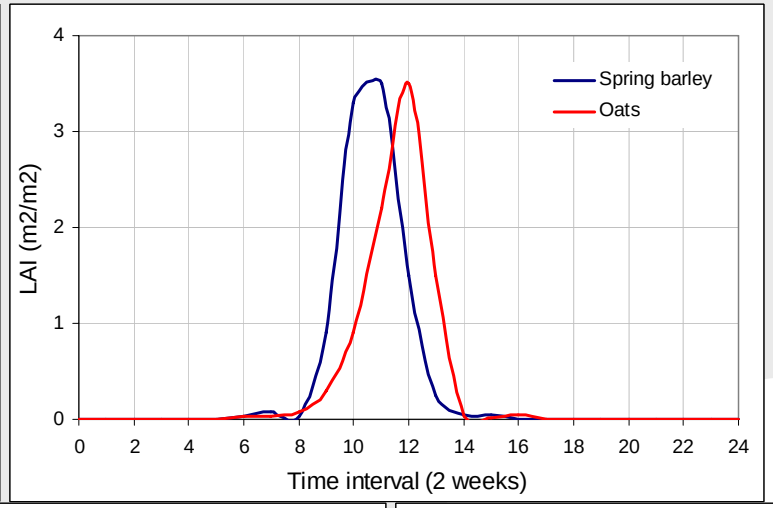
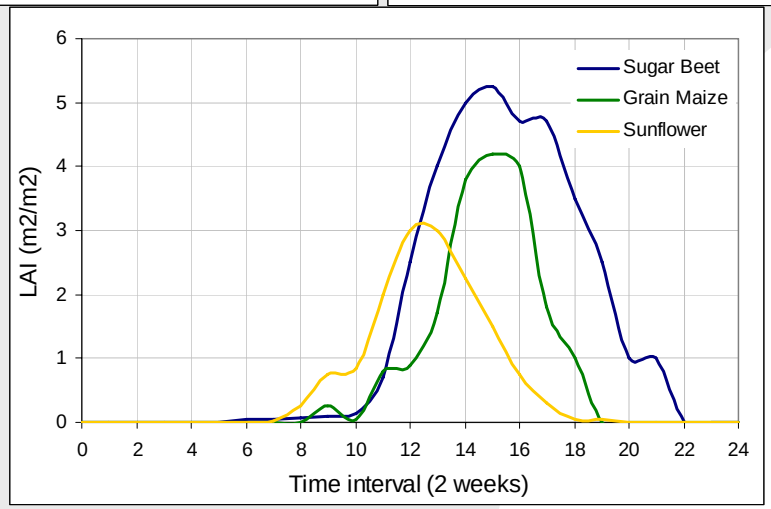
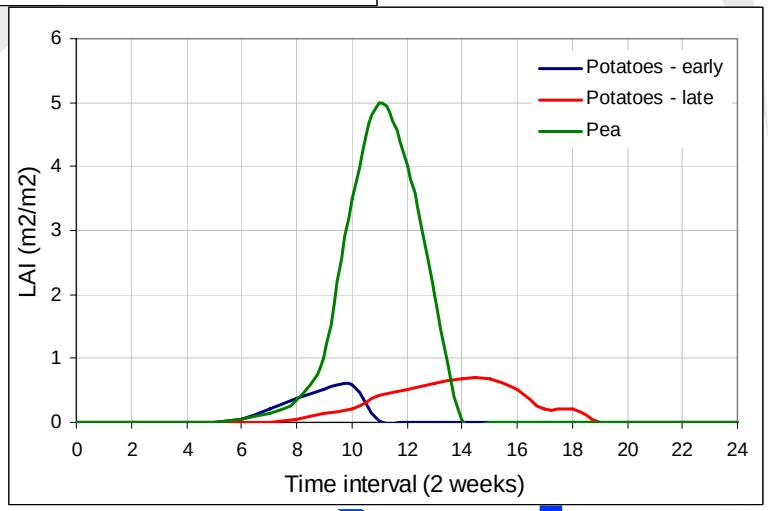
MATERIALS AND METHODS

Main principal - phenology development









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MATERIALS AND METHODS

Nomenclature definition:

- Winter crops (winter wheat, winter barley, rye)
- Spring crops (spring barley, spring wheat, oats, etc.)
- Oilseed Rape
- Summer crops (grain maize, sunflower, sugar beet, etc.)
- Other crops (vegetables, legumes, technical crops, etc.)

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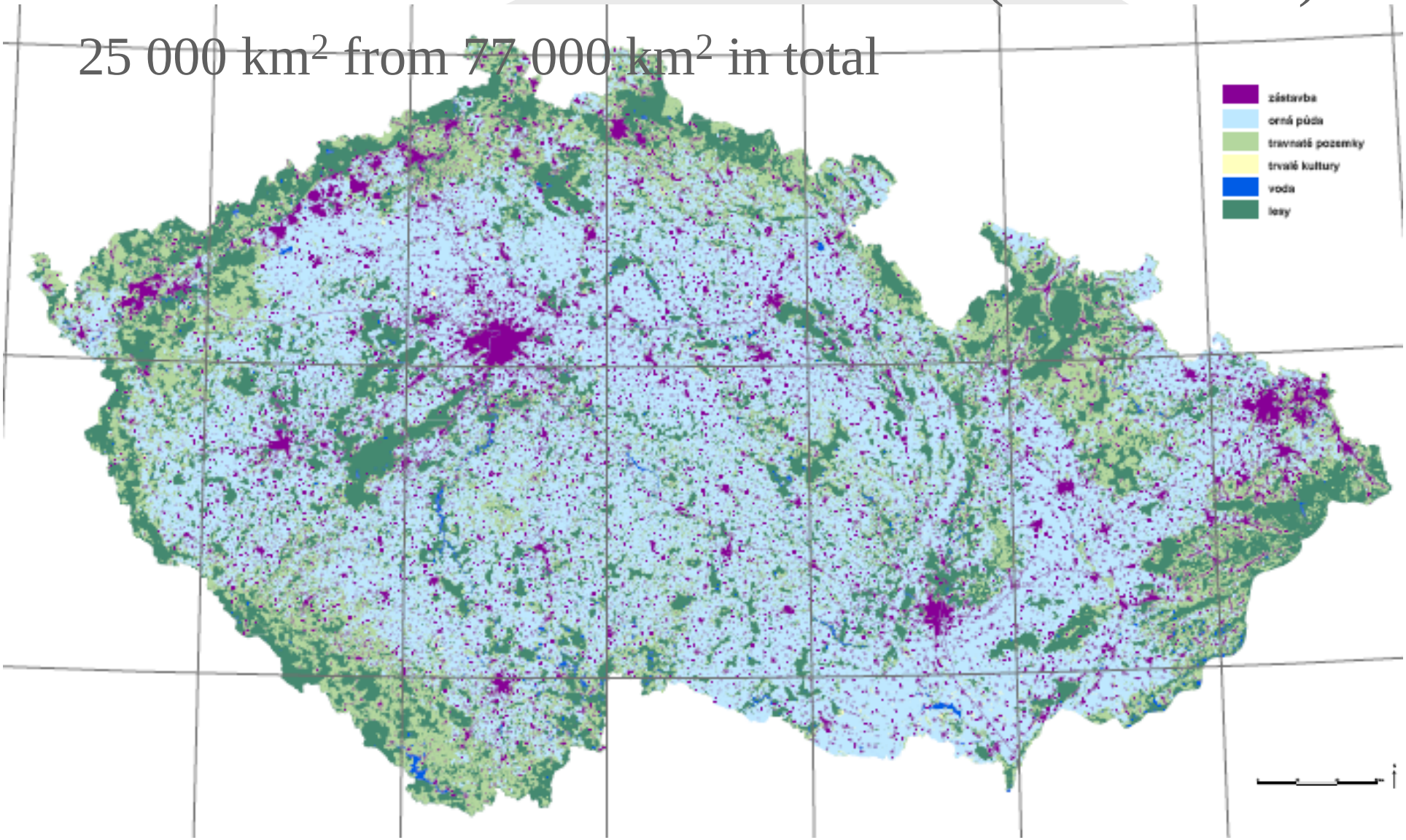
MATERIALS AND METHODS

Arable mask – national Land Cover (MMU: 1 ha)

25 000 km^2 from 77 000 km^2 in total



MATERIALS AND METHODS

Classification model: Artificial Neural Network

Training samples: ground survey (limited no. of samples); additional samples – visual interpretation of crops in the fields on HR data based on ground survey

~ *200 samples per class*

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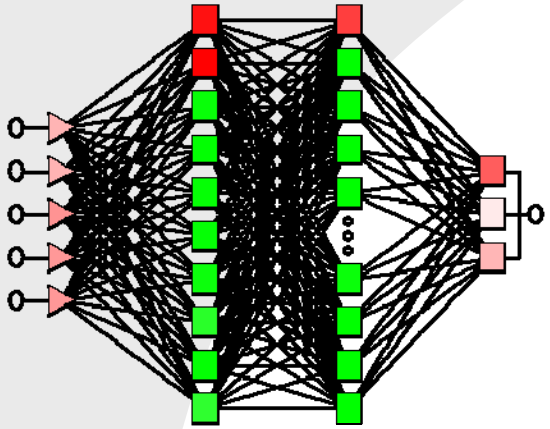
RESULTS

- 1st stage of classification – 3 crop groups
  - Winter crops
  - Spring crops
  - Summer crops

ANN model (MLP: 3 in, 13 hidden, 3 out)

Correct classification rate: 0.974



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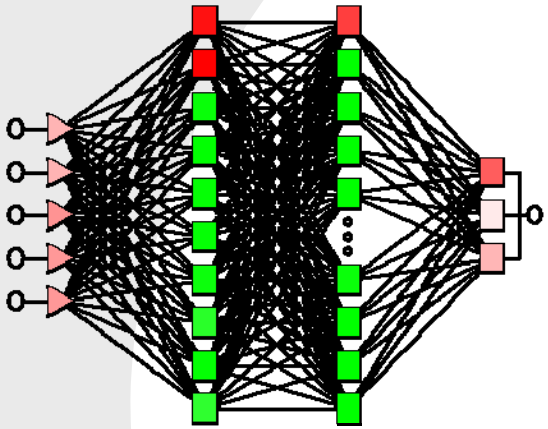
RESULTS

- 2nd stage of classification – 5 crop groups
  - Winter crops (10)
  - Spring crops (20)
  - Oilseed rape (30)
  - Summer crops (40)
  - Other crops (50)

ANN model (MLP: 5 in, 12 hidden, 5 out)

Correct classification rate: 0.930



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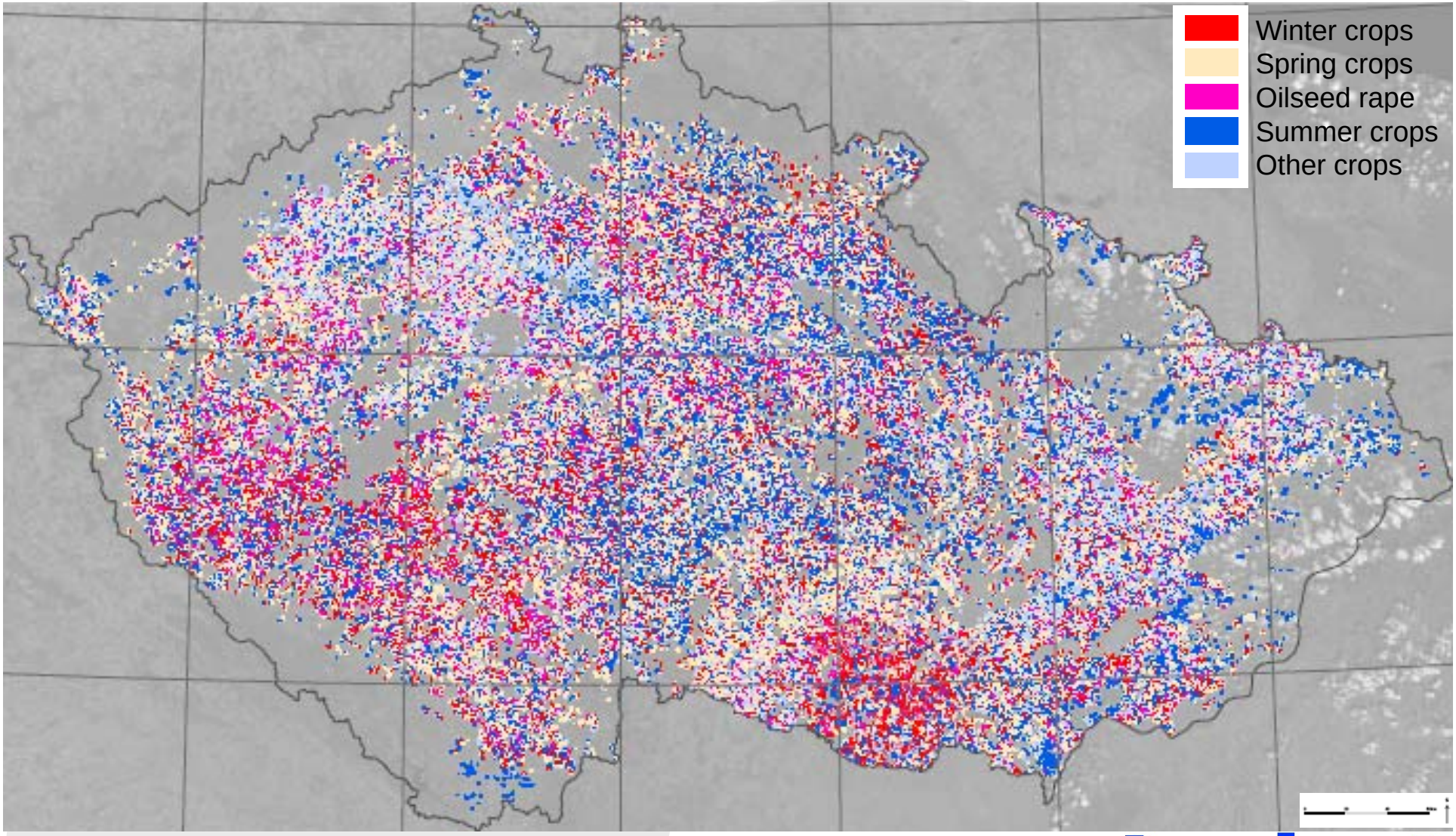
Crop groups distribution

RESULTS



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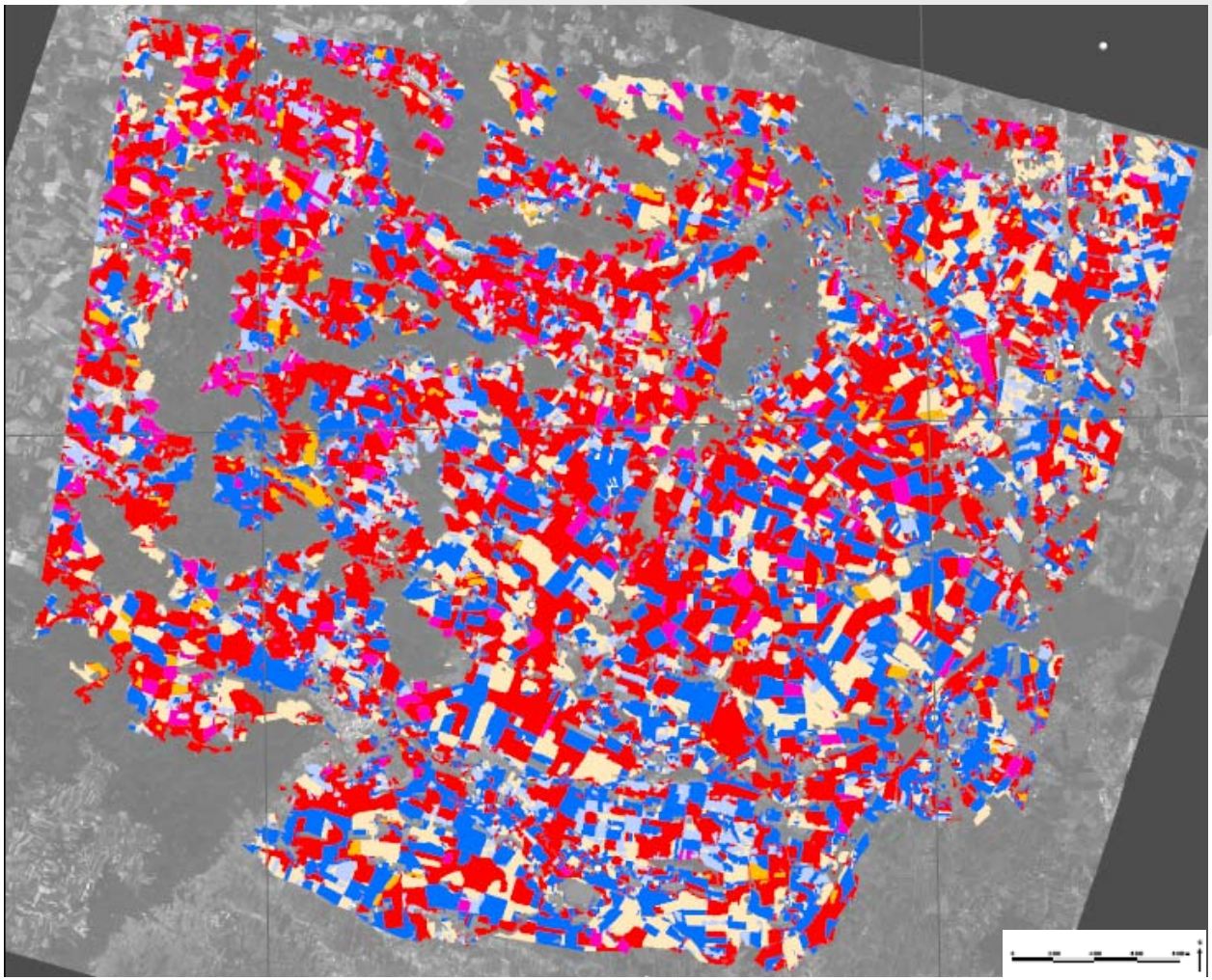
RESULTS

Accuracy assessment – HR data

94.4 %

OBIA +

post-editing



- Permanent crops
- Oilseed rape
- Legumes, forage
- Winter crops
- Spring crops
- Summer crops
- Other crops

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RESULTS

Accuracy assessment

– validation on independent HR data classification

- 1st stage of classification – 3 crop groups
  - Overall accuracy: 77.2 %
- 2nd stage of classification – 5 crop groups
  - Overall accuracy: 68.1 %

  -> reference data accounting > 75% fraction area of one crop in the 300 m pixel
  - Overall accuracy: 74.1 %; increased by 6 %

CLASS	Overall Accuracy (%)
10	86.2
20	62.2
30	71.7
40	61.7
50	61.2

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CONCLUSSIONS

Classification accuracy

- 3 crops: good; 5 crops: improvements expected
- Good accuracy of winter crops classification
- Lower accuracy of spring and summer classification (expected higher)
- Higher accuracy at district (e.g. NUTS4/5) level can be expected

Improvements

- ANN with mixture model should be tested
- More (cloud free) data needed in high season!
- Increase evenly distributed training data

Generally

- Near-operational service after some improvements, cheap and practical technique with every year updates

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PROJECTS

- **CGMS-CZ (Crop Growth Monitoring System for the Czech Republic)**

  ESA Category-1 Project (ref. 4358), PI

  GISAT and Charles University

- **Pesticides transport in hydrosphere of the Czech Republic, new methods for optimization of pesticide monitoring**

  Czech Hydrometeorological Institute and Czech University of Life Sciences, Prague

- Nitrogen and Phosphorus monitoring from agricultural land use (?)

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APPLICATION

Downstream example

Pesticides occurrence and transport in hydrosphere of the Czech Republic and new methods of optimization of pesticide monitoring

Radka Kodesova[a], Vit Kodes[b]

a) Czech University of Life Sciences, Prague, Dept. of Soil Science and Protection

b) Czech Hydrometeorological Institute, Dept. of Water Quality

Goals:

1) localization of frequent applications of specific pesticides based on information collected by State Phytosanitary Administration, knowledge of soil utilization, climatic conditions, and remote sensing data (Land Use data),

2) evaluation of soil cover impact on water flow and pesticide transport and consequently on groundwater contamination.

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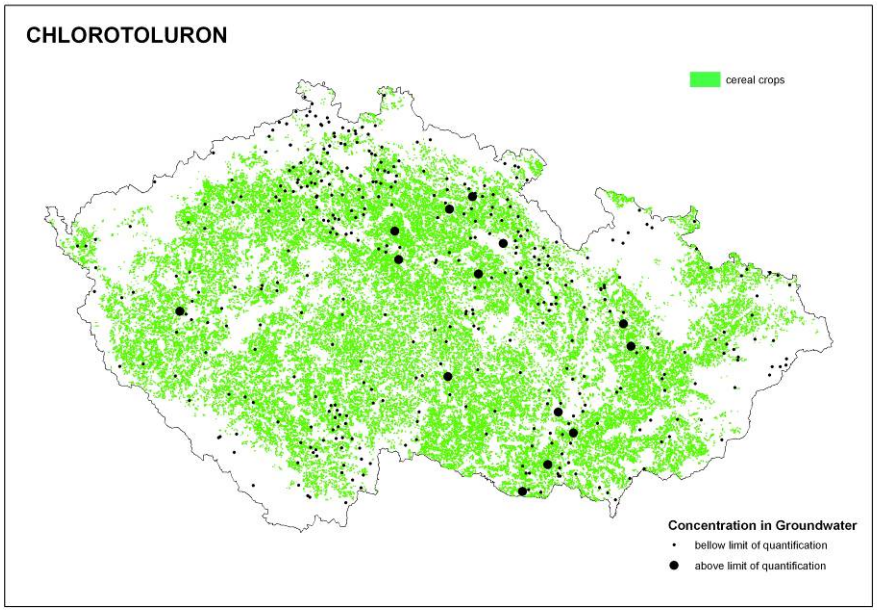
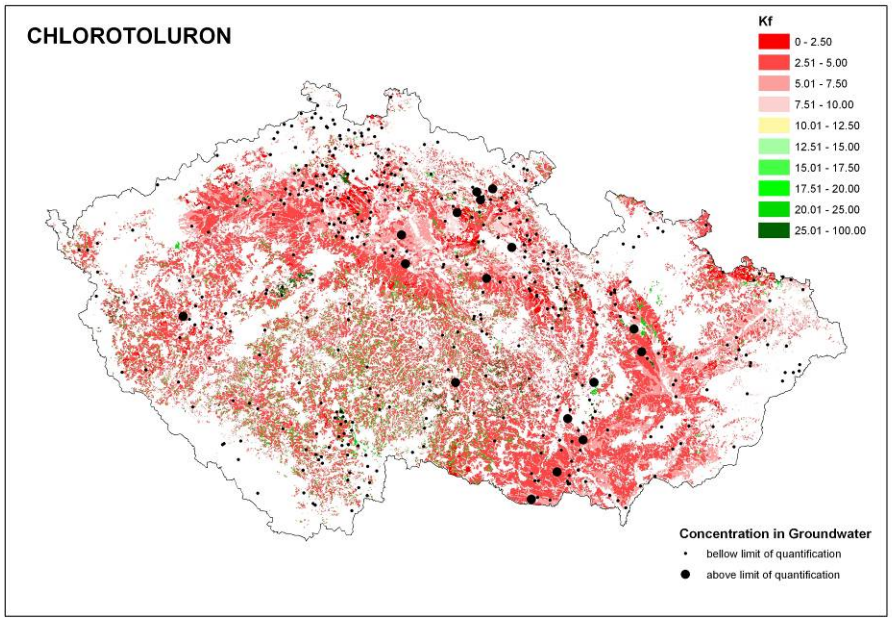
APPLICATION

Study on Chlortoluron: related crop distribution and concentration in groundwater

Determination of distribution coefficient (indication of soil sorption ability – predicting level of risk)





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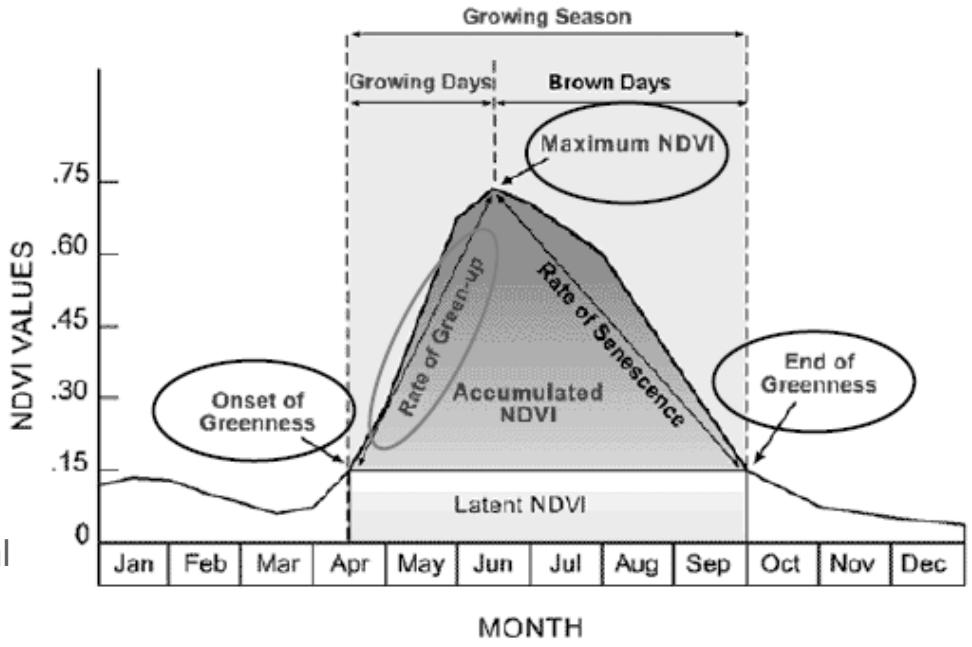
APPLICATION 2

Downstream application

- Derivation of phenology parameters from vegetaion indicators - **crop specific**
- Lack of data (time series)!



From http://www.terrametricsag.com/DataSets.html

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Thank you for your attention!

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