Ciraçao de uma interface amigavel para Forest-BGC

Miguel A. Veganzones

Computational Intelligence Group
Basque Country University

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Outline

Location

San Sebastian

People

- The group has been evaluated as a Level 'A' University Researching Group (the maximum possible level) by the Education, Universities and Research Department of the Basque Government.
- More than 20 professors.
- About 10-15 PhD students.
- Two spin-offs:
  - Innovae Vision
  - Nesplora
- Collaboration with national and international institutions, industry, ...

Background

- Computer vision: robotics, medical imagery, remote sensing, quality processes...
- Neural networks, chaos-based cryptography and control systems.
- Statistical machine learning.
- Speech and emotions analysis.
- Social networks, technology for neurosciences, avatars, 3D modelization ...

Forest-BGC

- The Forest-BGC (Bio-Geochemical Cycles) was developed by Running and Coughlan on 1998.
- Calculates key processes involved in the carbon, nitrogen and water cycles in forest ecosystems.
- There are a hundred of variables of input required for the functioning of the model.

Leaf Area Index (LAI)

- Represents the ratio of leaf area per unit groud area.
- Probably, the most important independent variable used by the model for measuring vegetation structure over large areas.
- Most ecosystems process models that simulate carbon and hydrologic cycles require LAI as an input data.

Motivation

- To use remote sensing imagery to estimate NPP values for large areas.
- To use remote sensing LAI products as input of the Forest-BGC algorithm.
- To obtain NPP images as a final result -> estimates of carbon fixation.

Coughlan's implementation

- SIMLAT 5 (1998): implemented in Turbo Pascal.
- Very rudimentary, console-based interface.
- Only available for Microsoft Windows.
- It doesn't allow automatic multiple NPP estimates.

Simlat 5

- Inputs:
  - Climate data (.clm file).
  - Study area information (.dat file).
- Outputs:
  - Respiration and Gross Primary Production.
  - NPP = GPP - Respiration.

LAI data

AMA01.dat - Bloco de notas

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Ama01.DAT COMMENT LINE
          (CONT'D)
1     KSTART =  START SIMULATION LOOP COUNTER
365   STOP   =  STOP SIMULATION LOOP, DAY
0     DAY    OUTPUT CONTROL: 1 MEANS  YES; 0 MEANS  NO
1     GRW    OUTPUT CONTROL: 1 MEANS  YES; 0 MEANS  NO
0     LNG    OUTPUT CONTROL: 1 MEANS  YES; 0 MEANS  NO
5     KPRINT =  IF KPRINT = 10 THEN OUTPUT ONCE EVERY 10 ITERATIONS
0     KBEGIN =  BEGIN PRINTING AFTER ITERATION > KBEGIN
365   LOOP   =  LOOP TO THE CARBON/NIT SUBMODEL EVERY xx DAYS
0     LIFE CYCLE REDEFINE B CONSTANTS WITH LOOP # (1=YES, 0=NO, *.LIF FILE)
0     SEASONALLY REDEFINE B CONSTANTS WITH YEARDAY (1=YES, 0=NO, *.SEA FILE)
0     NEGX   =  PRINT ERROR MESSAGES WHEN X(I) IS NEGATIVE: 1 MEANS YES.
20          NUMX   = NUMBER OF X VALUES TO READ
0.0         X(  1)   SNOWPACK                ( M**3 )
1500.0      X(  2)   SOIL WATER CONTENT      ( M**3 )
0.0         X(  3)   WATER OUTFLOW           ( M**3 )
0.0         X(  4)   TRANSPIRATION           ( M**3 )
0.0         X(  5)   EVAPORATION             ( M**3 )
0.0         X(  6)   PSN                     ( KG )
0.0         X(  7)   RESPIRATION AUTOTROPHIC ( KG )
2066        X(  8)   LEAF CARBON             ( KG )
25677       X(  9)   STEM CARBON             ( KG )
4062        X( 10)   ROOT CARBON             ( KG )
0.0         X( 11)   LEAF/ROOT LITTER CARBON ( KG )
0.0         X( 12)   RESPIRATION DECOMP, C   ( KG )
0.0         X( 13)   SOIL CARBON             ( KG )
0.0         X( 14)   AVAILABLE NITROGEN      ( KG )
70.0        X( 15)   LEAF NITROGEN(1.5% OF X8)( KG )
0.0         X( 16)   STEM NITROGEN           ( KG )
0.0         X( 17)   ROOT NITROGEN(.75% OF X10( KG )
0.0         X( 18)   L/R LITTER NITROGEN 1%X11( KG )
0.0         X( 19)   SOIL NITROGEN           ( KG )
0.0         X( 20)   NITROGEN LOSS           ( KG )
45          NUMB   = NUMBER OF B CONSTANTS TO READ
8.3         B(  1)   SPECIFIC LEAF AREA      (M**2/KG C)
-0.6        B(  2)   CANOPY LIGHT EXTINCTION COEFFICIENT
1500.0      B(  3)   SOIL WATER CAPACITY     (M**3)
```

Goals

- Try to automatize the process of using Forest-BGC algorithm to estimate NPP values for multiple LAI values.
- Get the results as usable information (images, excell files, ...).

Approaches

1. Encapsulate Coughlan's implementation in a new program.
2. Modify Coughlan's implementation.
3. Reimplement Forest-BGC.

Current implementation

- Reimplements part of the Forest-BGC algorithm.
- Made in Java >= 1.5: multiplatform.
- Easy to use and fully automatic.
- Reuse climate and data files.
- Tested against Coughlan's implementation.

Interface

LET SEE IT IN ACTION -> problable demo effect!!

Future work

- Introduce more features of the Forest-BGC model if needed: any suggestion?
- Improve input/output data files.
- Improve interface.

Summary

- Forest-BGC allows estimation of NPP values using climate and study area information.
- LAI is one of the most important variables of the model.
- Estimate NPP values for large areas using LAI remote sensing products (like MODIS).
- Reimplementation of Forest-BGC to improve usability.

Questions?

Thank you very much for your attention.

- Contact:
  - Miguel Angel Veganzones
  - Computational Intelligence Group
  - Basque Country University (Spain)
  - E-mail: miguelangel.veganzones@ehu.es
  - Web page: http://www.ehu.es/computationalintelligence