HiProGen

A system to generate high level products

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Introduction

The High level Product Generation (HiProGen) system was developed by an industrial consortium of Infoterra Ltd. (www.infoterra-global.com) of the UK and VTT of Finland under a TRP contract with ESA. The HiProGen project has created a demonstration system that can automatically convert low level Earth Observation (EO) data to geocoded, geophysical composites and wide area mosaic products. The system demonstrates the following features:

- automatic generation of Level 3 products from lower level EO data (specifically MERIS Level 1 and 2; ASAR Level 1 Wide and Global Monitoring and Level 1 ATSR-2 / AATSR);
- WWW enabled interface to allow users to initiate data export or new product generation;
- output of Level 3 products in a range of projections and data formats;
- a flexible architecture which allows easy extension of the system to generate new and improved Level 3 products;
- an expandable and portable system which can be distributed across several platforms to increase production capacity.

Five example (non-validated) terrestrial geophysical products are generated by the system as weekly and monthly global composites. These are broadband Albedo, Global Vegetation Index, fraction of Photosynthetically Active Radiation, Leaf Area Index and Net Primary Productivity. In addition the system can generate regional ASAR mosaics and weekly/monthly composites of MERIS Level 2 algal_1 and algal_2 pigment concentrations.

System Architecture

The modular architecture and Object Oriented implementation of HiProGen are key to the flexibility and extensibility of the system. The core subsystems each run in a separate Java Virtual Machine with the subsystems communicating via Java Remote Method Invocation. This allows the subsystems to be distributed across an Internet and means that duplicate subsystems can be added as production demand requires. Processing instructions, system configuration parameters and metadata are all stored in XML formatted text files.

To ease the integration of new algorithms into the HiProGen production environment, software ‘wrappers’ are used to control different types of processing (e.g. Java, C/C++ executables and IDL batch procedures).

Referring to Figure 1, the Java process wrapper can handle processing parameters specific to running Java software. The IDL process wrapper is written to deal with running IDL batch files and likewise the executable process wrapper is designed to run ‘exe’ files at the command line.

In each case, the details of how specific types of processing are carried out are hidden. The top level class responsible for executing processing instructions is therefore able to run a Java process as easily as a command line executable. Because all the processing specific wrappers support the generic ‘run’ behaviour of the parent LiteralProcess class in a different way. Note that new types of processes (e.g. Batch scripts) can be handled by creating new sub-classes of LiteralProcess.

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The incorporated software works out the relative area of overlap of each input data sample with each output data sample in the output product grid.

Comparing Figures 4 and 5 it is almost impossible to distinguish the borders of the FR quarter scene from the edges of the GAI product.

Results

System stress testing is carried out with over 160 orbital segments of MERIS Level 1 RR data for the land products and over 140 passes of Level 2 RR data for the marine Global Algal Index (GAI) product.

Processing of a single, 80°N to 70°S 10° x 10° orbital segment takes under an hour on a dual 2.4 GHz Xeon PC.

In other words, the HiProGen demonstrator can composite input MERIS data in 80°N to 70°S land products and over 140 passes of Level 2 RR data for the marine Global Algal Index (GAI) product.

The HiProGen demonstrator can composite input MERIS data in

The cloud masking algorithm excludes data with very high reflectance. Note the effect on ice covered areas and the Sahara desert.

Figure 3 Global land surface albedo for April 2003, Plate Carree (equi-rectangular non-projected) map with an equatorial spatial resolution of 1.2km. The cloud masking algorithm excludes data with very high reflectance. Note the effect on ice covered areas and the Sahara desert.

Figure 2 Global Algal Index (GAI) Case 1 coverage over the central Mediterranean using algal_1 MERIS RR data for July 2003, incorporating a single quarter scene of MERIS FR data. Output sample size is 300m x 300m.

Figure 4 Number of observations per bin using the standard sinning algorithm supplied with BEAM V2.0. This 40° x 40° tile was created using algal_1 MERIS RR data covering July 2003 with a single quarter scene of MERIS FR data. Bin size is 2km x 2km. About 50 FR data samples are accumulated in each bin compared to about 3 samples of the lower resolution RR data.

Figure 5 Number of observations per sampled pixel. This mosaic of four 10° x 10° tiles was created using algal_2 MERIS RR data covering July 2003 with a single quarter scene of MERIS FR data (in centre). Sample size is 300m x 300m.