Visualizing and sharing Geoprocessing Workflows in the AfriAlliance project

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ILWIS: the Integrated Land and Water Information System

Education-friendly interface of ILWIS GIS-EO software: linked-views, visual data catalog, raster metadata view, etc.

Create, debug and share geoprocessing workflows with visual workflow builder
The interoperability issue..
Shareability & Reproducibility

**Shareability**
Transfer workflow from one user/environment to another.
Requires a standard interchange format.

**Reproducibility**
Recreate and reuse workflow with same conditions to achieve similar results.
Requires provenance information.
## Comparison of workflow systems

<table>
<thead>
<tr>
<th>Property</th>
<th>ILWIS</th>
<th>QGIS</th>
<th>ERDAS</th>
<th>ArcGIS</th>
<th>BPM tools</th>
<th>OGC GPW</th>
<th>KNIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which exchange format is used?</td>
<td>JSON</td>
<td>JSON &amp; XML</td>
<td>JSON</td>
<td>Python</td>
<td>XML</td>
<td>XML</td>
<td>XML</td>
</tr>
<tr>
<td>Does the schema of the format conform to a standard?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Is the workflow reproducible from this format?</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Does it store enough metadata to describe a process?</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>-</td>
<td>Yes</td>
<td>-</td>
</tr>
<tr>
<td>Does it support workflow composition from remote services?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
Schema for standard interchange format
Architecture & implementation

- Schema design
- Schema implementation
- Interface development
- Workflow composition
- OGC Services implementations
- Workflow engine
- Service chaining
- Workflow execution
- Workflow Transformation

Diagram:
- Web Client
  - Create
  - Import
  - Export
  - Modify
  - Execute
- Internet
  - Request (JSON)
  - Response (JSON)
- Apache HTTP Server
  - Workflow Engine
    - Workflow Transformation
    - Workflow Execution
  - Python 3
- Libraries
- Remote services
- Data Services
  - WFS
  - WCS
  - SWE
  - Other
- Processing Services
  - WPS
  - Non-OGC RESTful Service
  - Other
- WPS Server
  - ILWIS
  - QGIS
  - ERDAS
  - ARCGIS
AfriAlliance project

Water Resources Monitoring & Forecasting using a Triple-Sensor Observation approach
Triple sensor approach sample workflow

Sub-Workflow SATSCAN

- CHIRPS Infrared
- TAMSAT
- RFE2

Region of interest

Derive accumulated Precipitation

Choice

LSASAF
Derive accumulated ET
P-ET

Sub-Workflow Groundscan

- Metao station
- GTS
- TAHMO

Region of interest

Choice

Derive accumulated ET
Derive accumulated Precipitation
P-ET

Sub-Workflow Citizen info scan

- Local weather station info
- Basic Local weather info

Derive accumulated Precipitation
P-ET

Citizen info on SD

Surplus Deficit (SD)
(Raster map, diagrams and tables)

Triple Collocation

Simple comparison
Evaluation report

Surplus Deficit (SD)
(Raster map, diagrams and tables)
Case study

Data Sources:

- Chirps rainfall (WCS)
- NOAA Climate Prediction Centre (SOS)
- Water Point Data Exchange database (SOS)
<table>
<thead>
<tr>
<th>Location</th>
<th>W1</th>
<th>W2</th>
<th>W3</th>
<th>Best performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>pnt_608</td>
<td>0.816</td>
<td>0.814</td>
<td>1.063</td>
<td>1.065</td>
</tr>
<tr>
<td>pnt_610</td>
<td>0.770</td>
<td>0.768</td>
<td>0.997</td>
<td>1.000</td>
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<tr>
<td>pnt_611</td>
<td>0.644</td>
<td>0.640</td>
<td>0.870</td>
<td>0.876</td>
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<tr>
<td>pnt_619</td>
<td>0.700</td>
<td>0.705</td>
<td>0.888</td>
<td>0.882</td>
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<tr>
<td>pnt_620</td>
<td>0.601</td>
<td>0.598</td>
<td>0.869</td>
<td>0.873</td>
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<tr>
<td>pnt_648</td>
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<td>0.729</td>
<td>0.725</td>
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<tr>
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<td>0.787</td>
<td>0.790</td>
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<tr>
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<td>1.004</td>
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<tr>
<td>pnt_1101</td>
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<td>0.911</td>
<td>0.912</td>
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<tr>
<td>pnt_1163</td>
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<td>1.062</td>
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<tr>
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<tr>
<td>RMSE</td>
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<td>0.019</td>
<td>0.011</td>
<td></td>
</tr>
</tbody>
</table>

**W1** ~ Satellite sensor, **W2** ~ In-situ sensor, **W3** ~ Citizen Sensor

**A** ~ Our method **B** ~ Mannaerts et al. (2018),
Result of triple sensor collocation

pnt 1163
Reporter : Ousmane
Ranking : Citizen, Satellite, InSitu
weight_Citizen : 1.55
weight_InSitu : 0.38
weight_Satellite : 0.57
error_Citizen : -104.95
error_InSitu : 291.95
error_Satellite : 44.67
Workflow software as Web application
Sharing the workflow with CAMUNDA WFMS
Further reading and contact


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