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TIDE,
the TropOMI Integrated Development Environment

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TIDE, TropOMI Integrated Development Environment

- TropOspheric Monitoring Instrument (TropOMI) is an imaging spectrograph in the line of OMI and SCIAMACHY
- Design Simulator running distributed over the internet to assist in the development of the TropOMI instrument and other future missions
  - Reduced risk of overdesign, based on level2 requirements
  - Increased cyclic improvement of specifications and design
- Partners: Dutch Space, KNMI, SRON, ARGOSS, TNO

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TIDE Simulator Characteristics

- All partners can operate the complete computational chain from their office
  - From scene to Level 2 product / Error analyzer
- Each partner manages his own application in its own environment
  - Contributions are as executable files + documentation or by providing a dedicated simulation service
  - No need to port applications
  - Protects intellectual property rights
- Make use of natural parallelization
  - Fan-out mechanism runs application in parallel for each input
  - Separate execution per ground pixel / swath running the same simulators on several processing nodes
- Based on web technology
  - Avoids firewall problems
  - Use of familiar tools
  - GridAssist workflow tool runs everywhere (Java) without installation (web-start)

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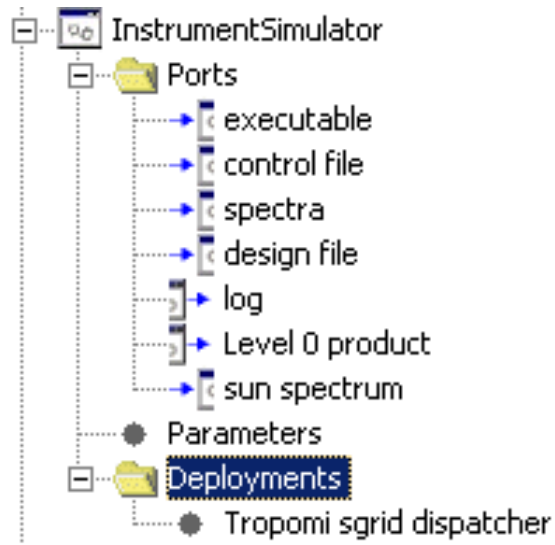
TIDE: Providing services

- TropOMI simulator consists of several applications from different partners
- Interface Control Documents
- Each application needs to be administered as a grid service (deployment)
  - definition of input and output files
  - specification of commands and required architecture
  - properties that specify optional and one-or-more files



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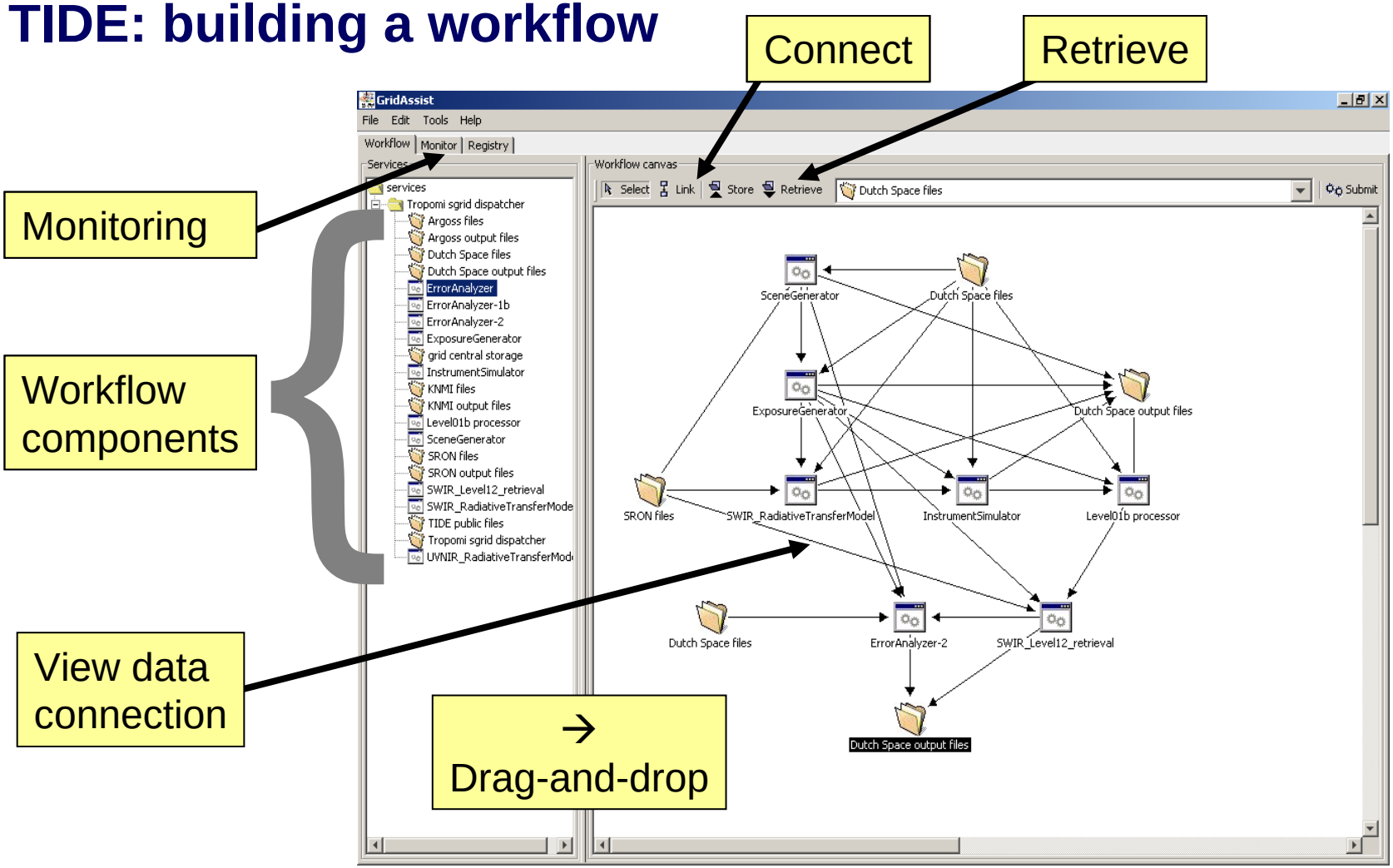
TIDE: building a workflow



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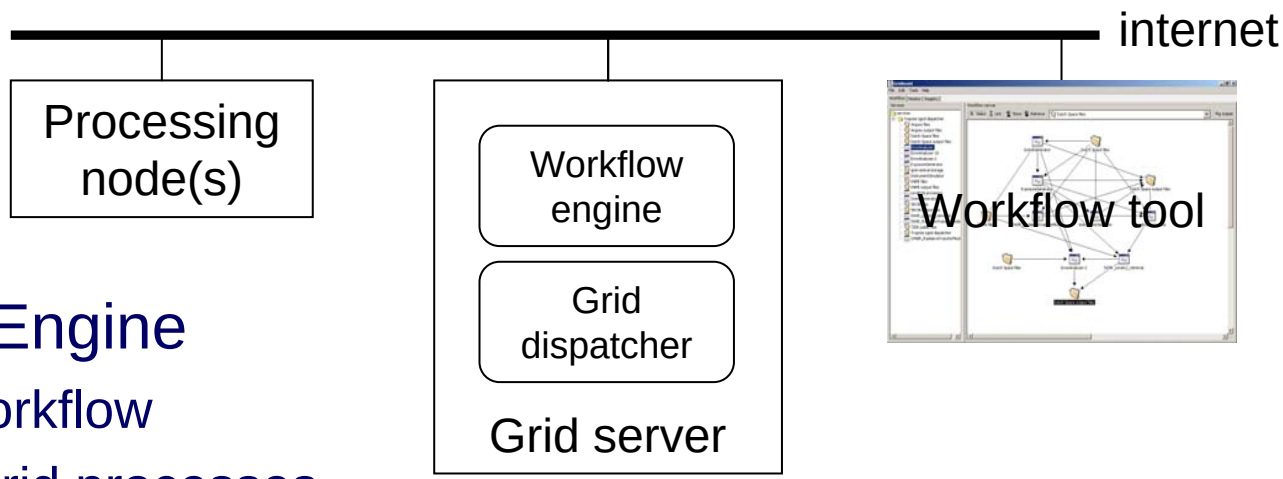
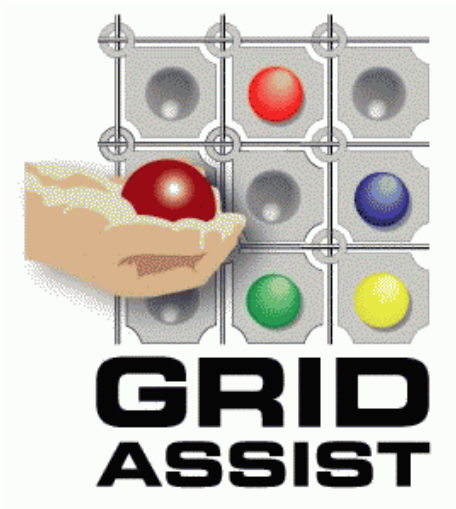
TIDE under the hood: Distributed Workflow Processing



- Workflow Engine
  - Parse workflow
  - Submit grid processes
  - Arrange file transports
  - Handle fan-out/fan-in
- Grid Dispatcher
  - Find appropriate processor
  - Transport files



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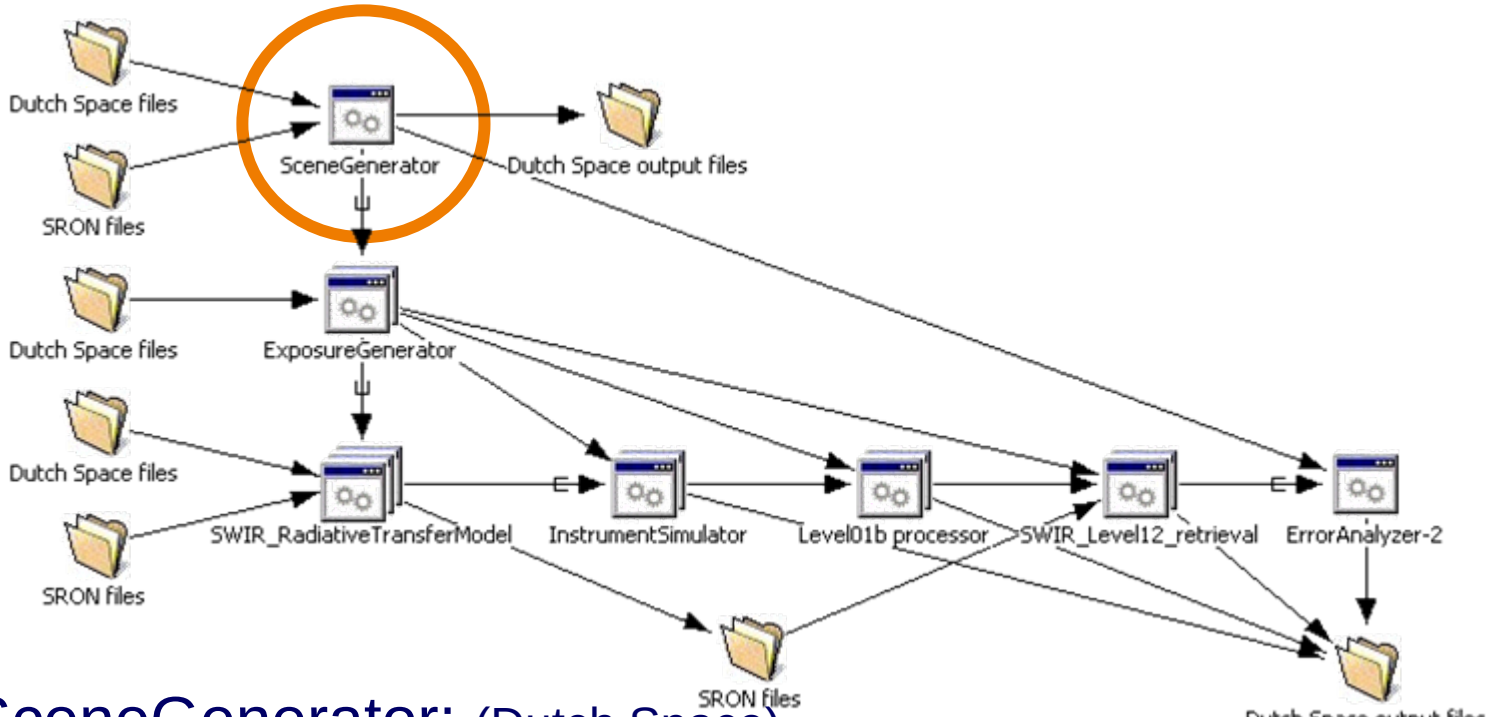
TIDE Simulator Components: Scene Generator



- SceneGenerator: (Dutch Space)
  - Generate a (test) atmosphere/orbit
  - It can also be input by an external file that contains the atmospheric information

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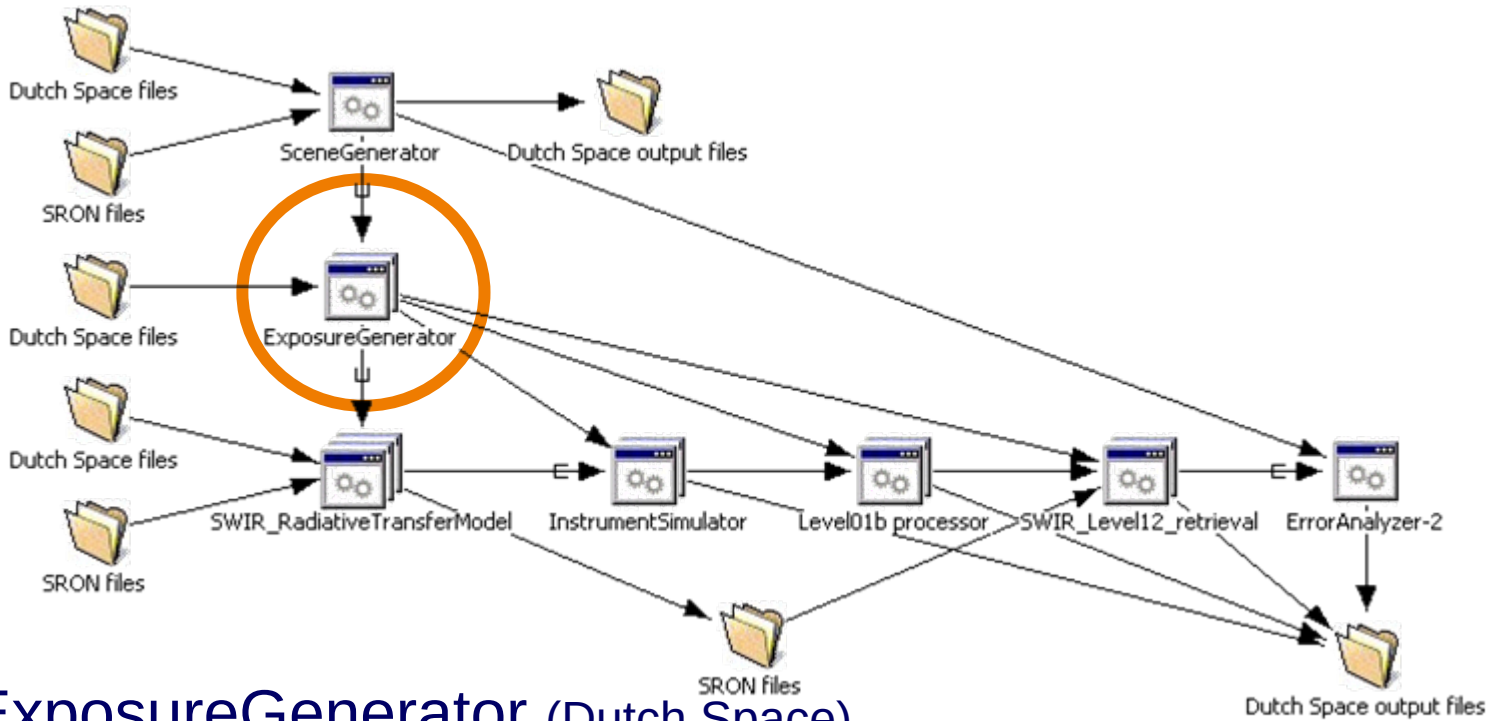
TIDE Simulator Components: Exposure Generator



- ExposureGenerator (Dutch Space)
  - Extension of the SceneGenerator, meant to help double-loop parallelism for the Grid system.

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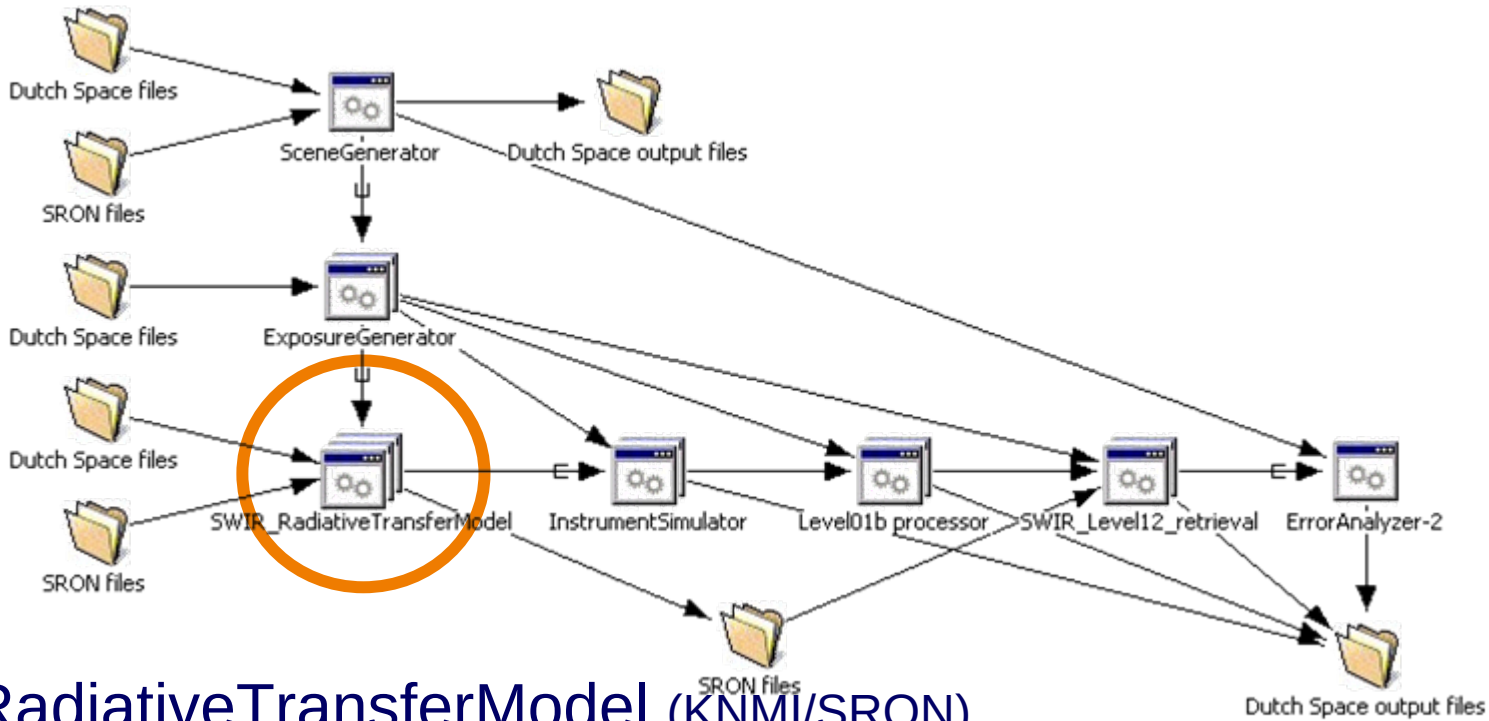
TIDE Simulator Components: Radiative Transfer Model



- RadiativeTransferModel (KNMI/SRON)
  - Generate radiance spectra from the input scenes created by the SceneGenerator and subject to the information from the ExposureGenerator.

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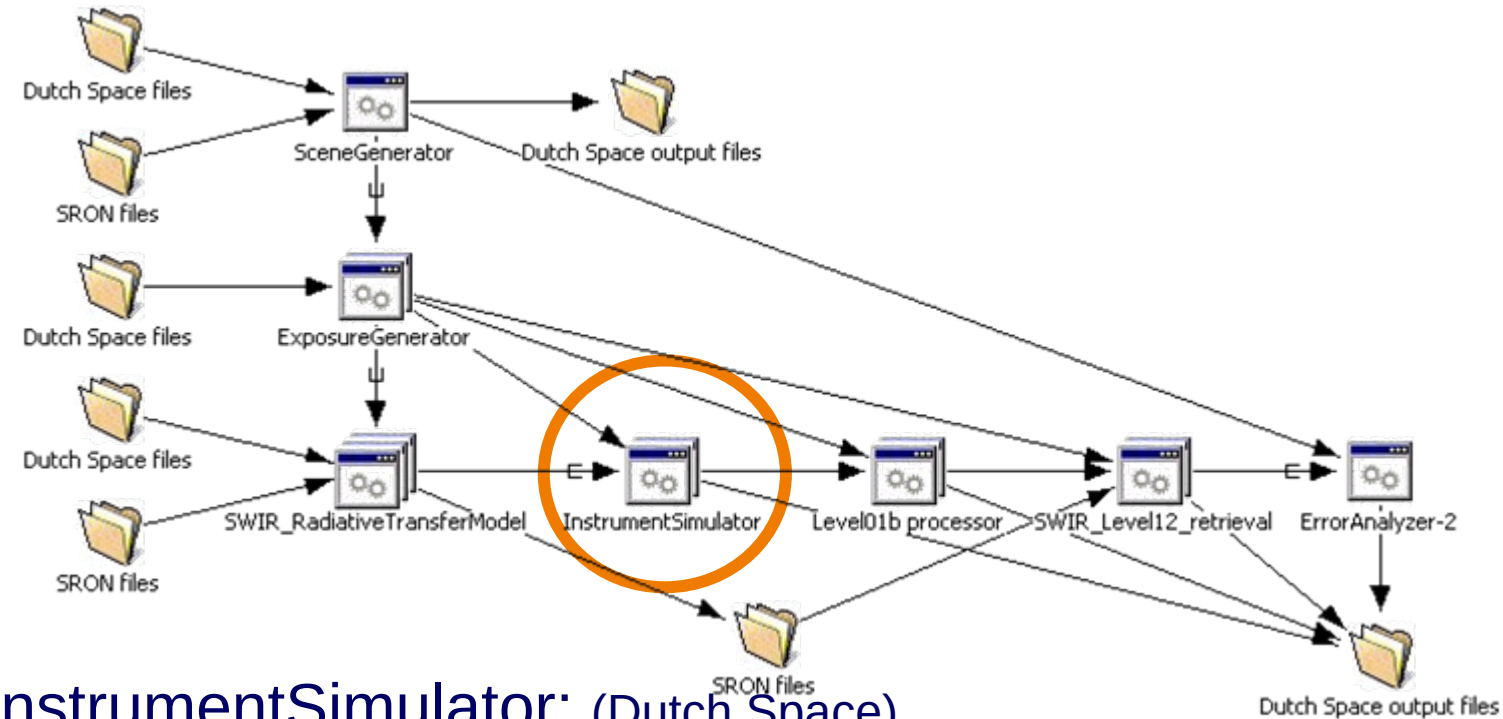
TIDE Simulator Components: Instrument Simulator



- InstrumentSimulator: (Dutch Space)
  - Takes radiance spectra and produce raw measurement data
  - Takes into account the instrument optics and detector and electronics performance in terms of noise and systematic errors.

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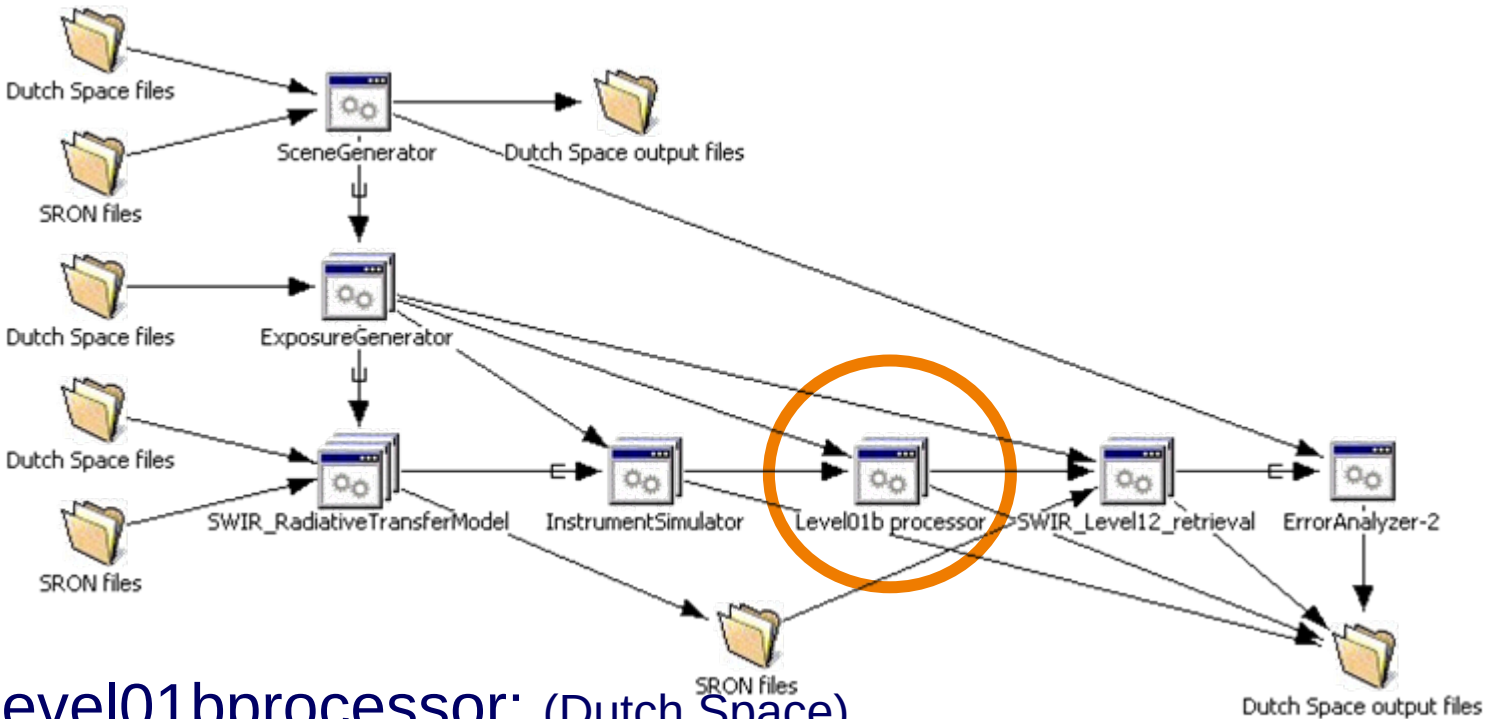
TIDE Simulator Components: Level01b processor



- Level01bprocessor: (Dutch Space)
  - Convert raw measurements created by the InstrumentSimulator to radiances, using information from the Calibration Key Database.

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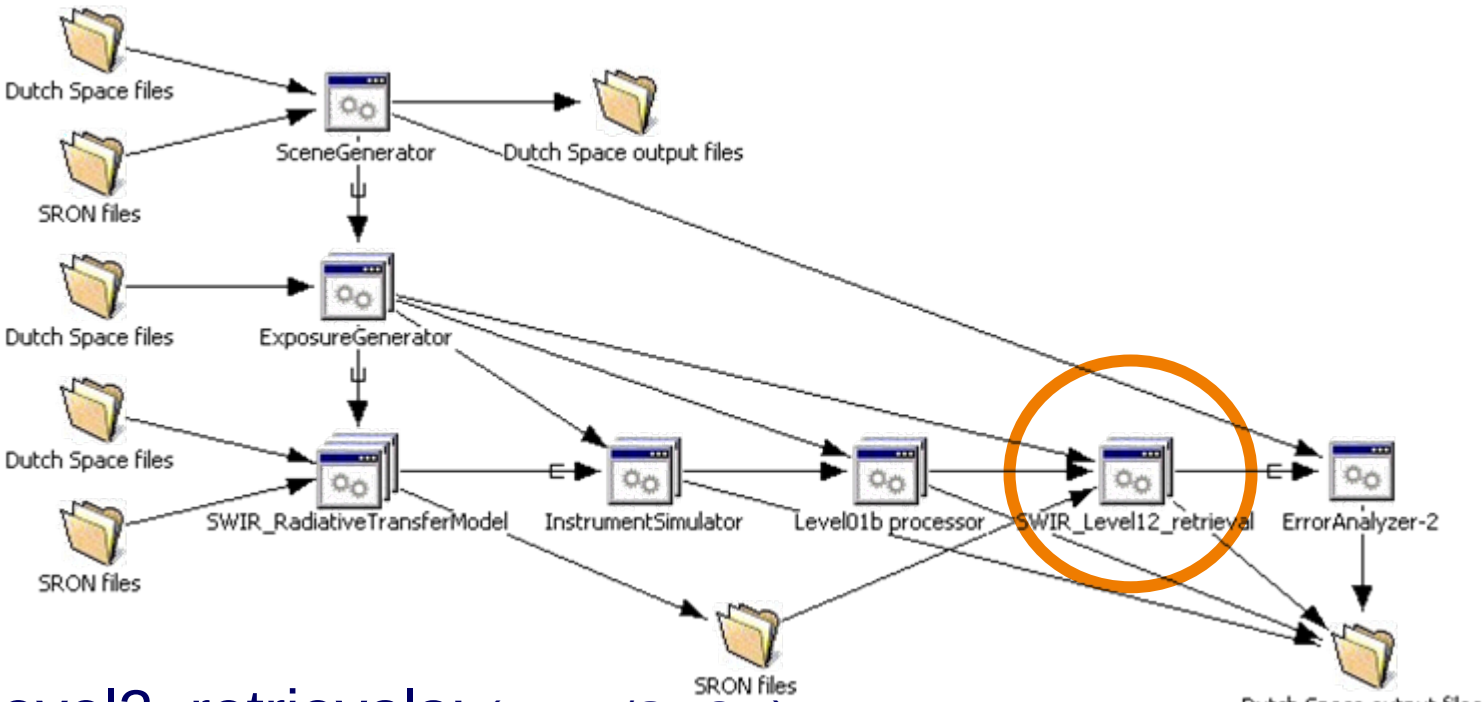
TIDE Simulator Components: Level2 retrievals



- Level2_retrievals: (KNMI/SRON)
  - Level 1b to 2 retrieval algorithm

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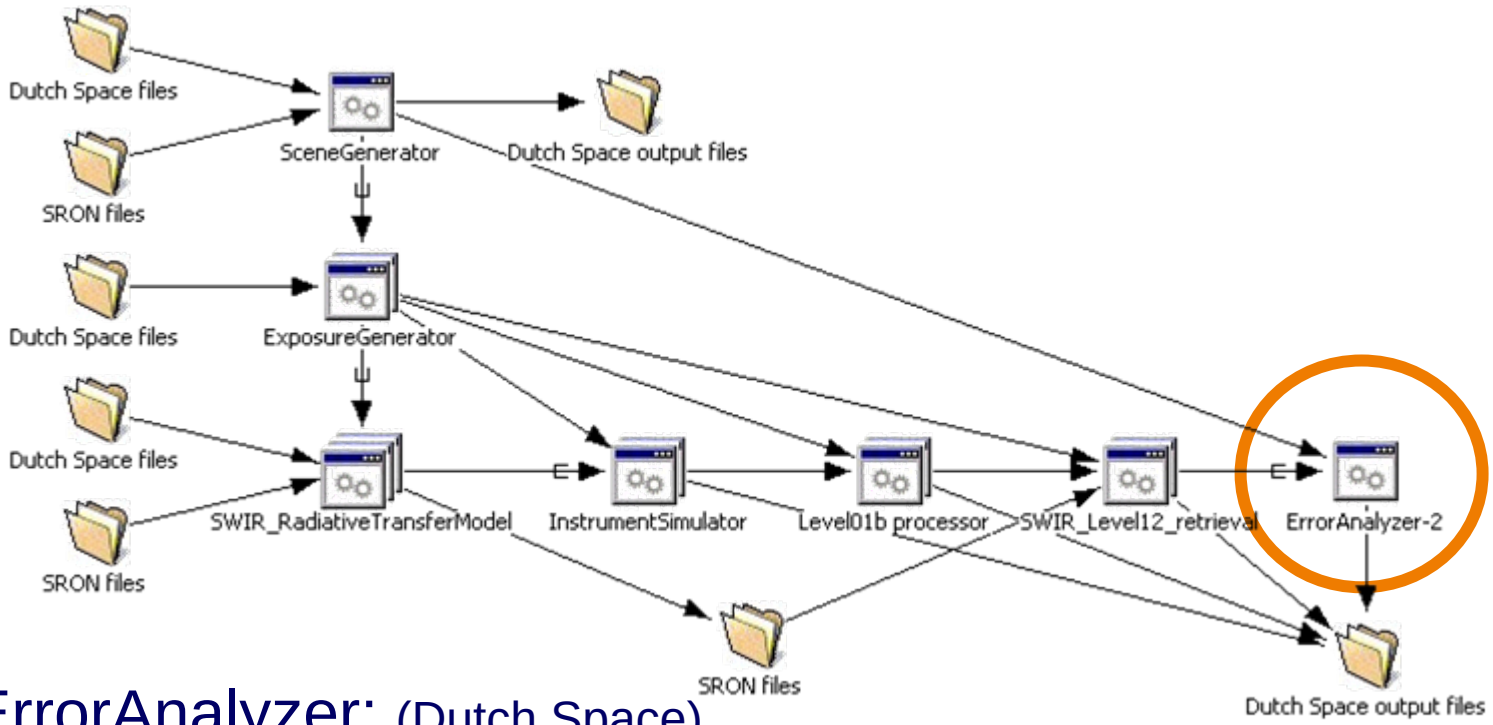
TIDE Simulator Components: Error Analyzer



- ErrorAnalyzer: (Dutch Space)
  - Compare the initial (test) atmosphere with the retrieved (level 2) products.

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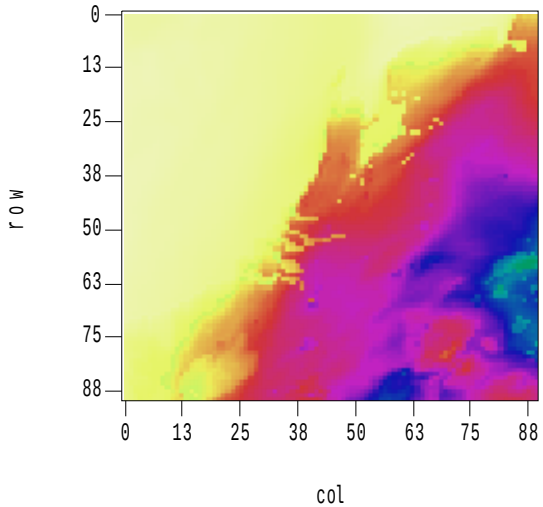
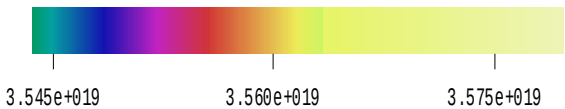
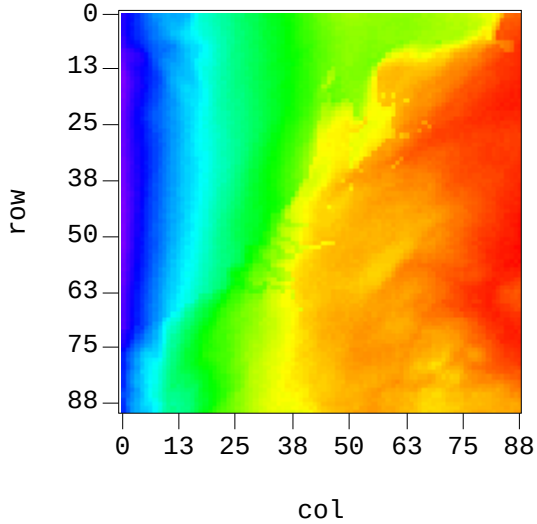
Example of using TIDE: the Netherlands



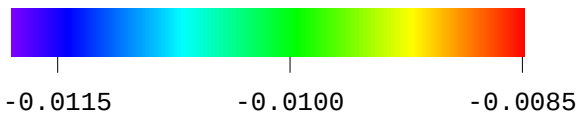


CH4

- input by realistic scene from the Netherlands
- Sensitivity test of full computing chain
- example: offset OPB temperatures 2 K ‘error’ in level 01b



- Methane total column



Relative difference

- Comparison input-output (Error Analyzer)

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Yggdrasill Virtual Data Centre

- Data services can be provided based on techniques used for distributed computing
- User web portal to geographically distributed service providers.
- Announcements about new data products
- Customized data products; user defined format conversion, visualization or even complete model runs to create the desired output.
- Prototype deployed for the national ‘Climate Changes Spatial Planning’ programme and for support to LOFAR

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Conclusions and Outlook

- Lessons learnt:
  - information technologists are needed to define the interfaces and properties of the applications
  - Fan-out is useful to exploit build-in parallelism but is hard to implement
- TIDE workflow and applications will be extended along with the TropOMI project
- A distributed design simulator is feasible and improves the quality of the design by involving end-users in an early stage

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Questions?

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