FloX integrated data flow: from tower to database
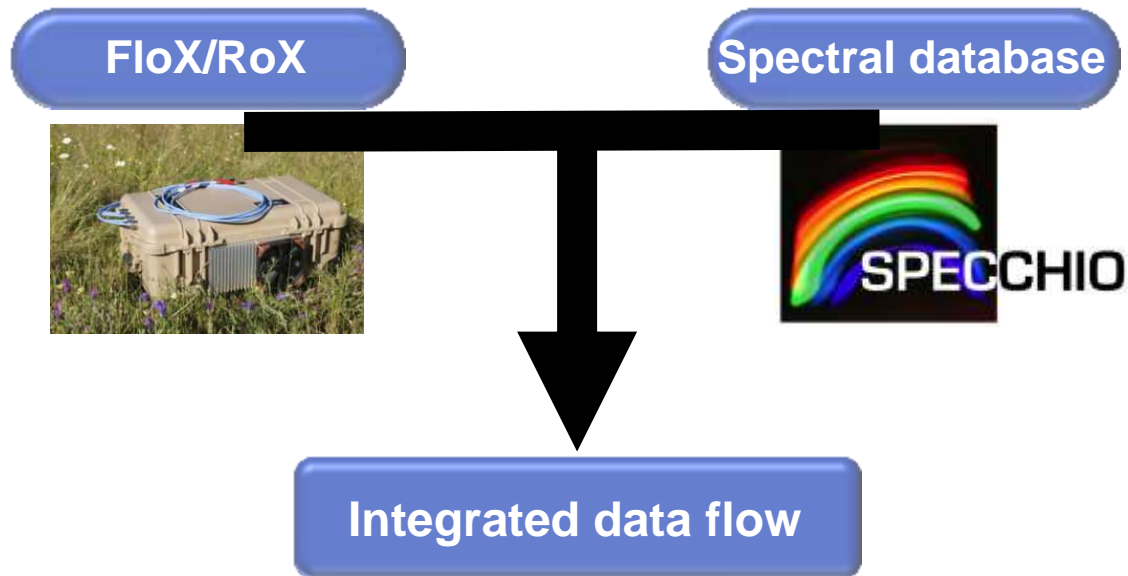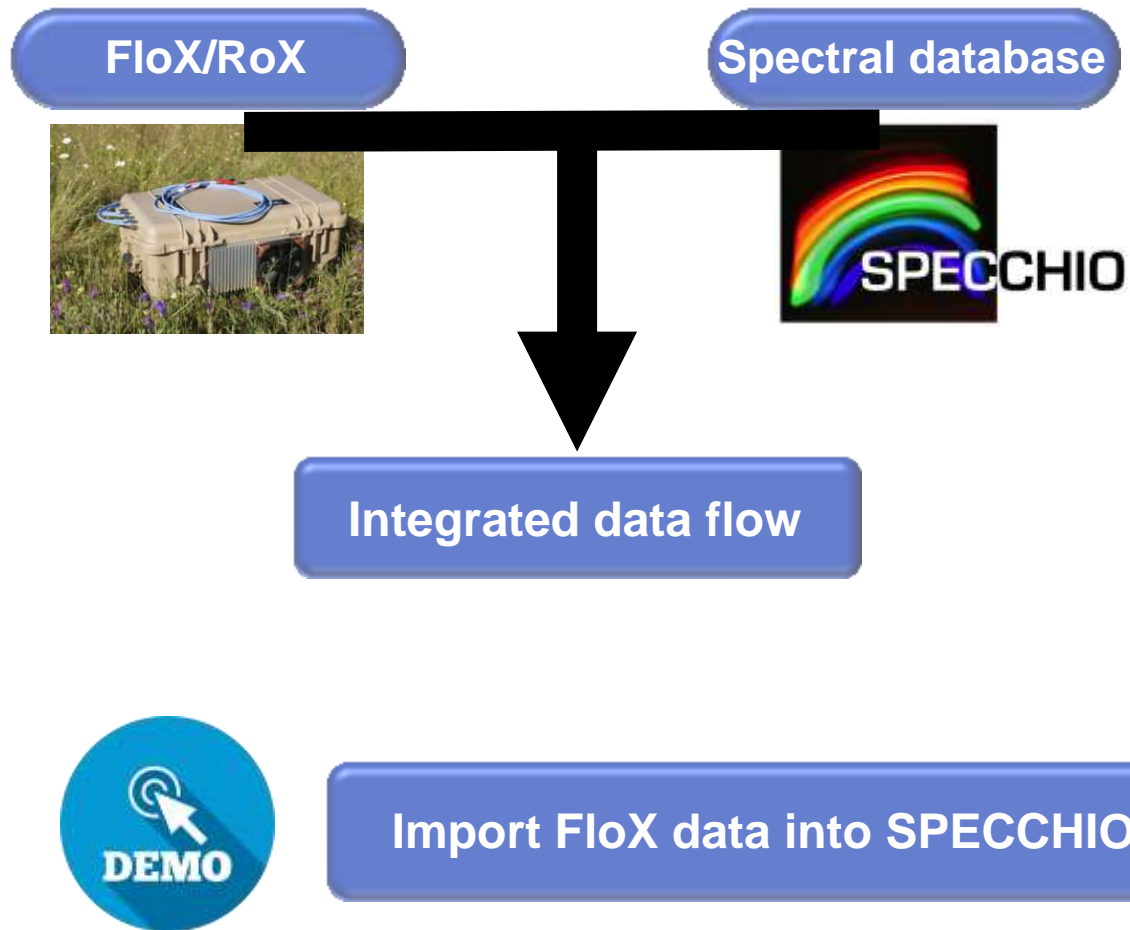
Andreas Hueni, **Simon Trim**
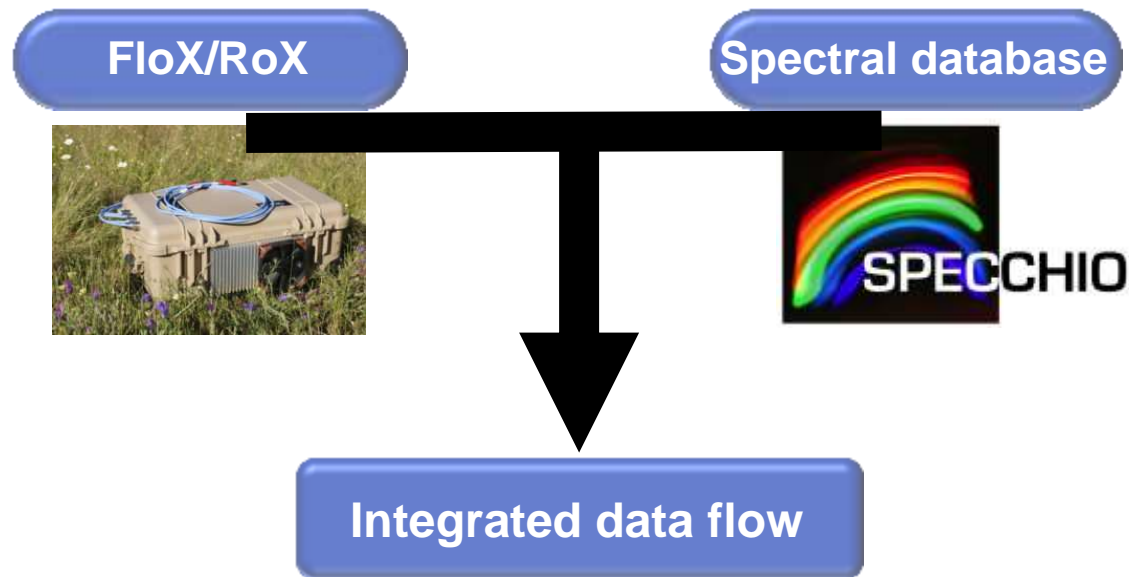
Overview

Overview

FloX/RoX

Spectral database

Integrated data flow

DEMO   Import FloX data into SPECCHIO

Overview

FloX/RoX

Spectral database

SPECCHIO

Integrated data flow

DEMO

Streamlined graphical user interfaces:
Java application to interface with FloX/RoX

Overview
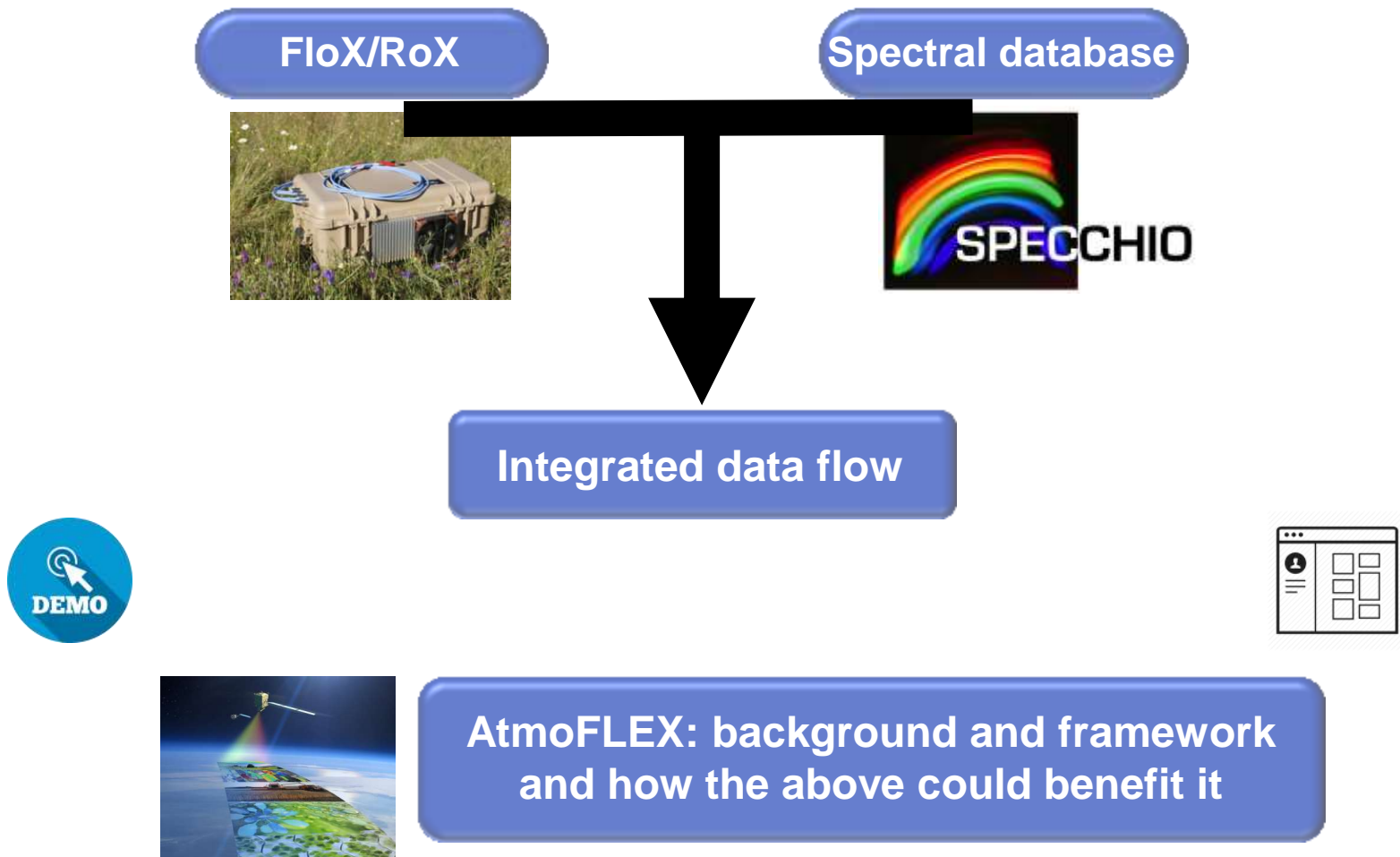
FloX/RoX

Spectral database

SPECCHIO

Integrated data flow

DEMO

AtmoFLEX: background and framework
and how the above could benefit it

FloX: Fluorescence boX and RoX: Reflectance boX Spectroradiometers

– Recent development from JB Hyperspectral Devices

– FloX: designed to passively measure sun-induced Chlorophyll fluorescence in the 650 *nm* to 800 *nm* spectral range

– RoX: designed to measure solar radiance, reflected radiance and reflectance covering the range from 300 *nm* to 950 *nm*

– Instruments **designed for autonomous long-term operations**, typically to be mounted on FLUX towers

JB Hyperspectral Devices

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➡ Can implement integrated data flow from tower to database

JB Hyperspectral Devices

Spectral Database SPECCHIO

Rationale: improve long-term usability and data sharing (A. Hueni *et al*., 2009)

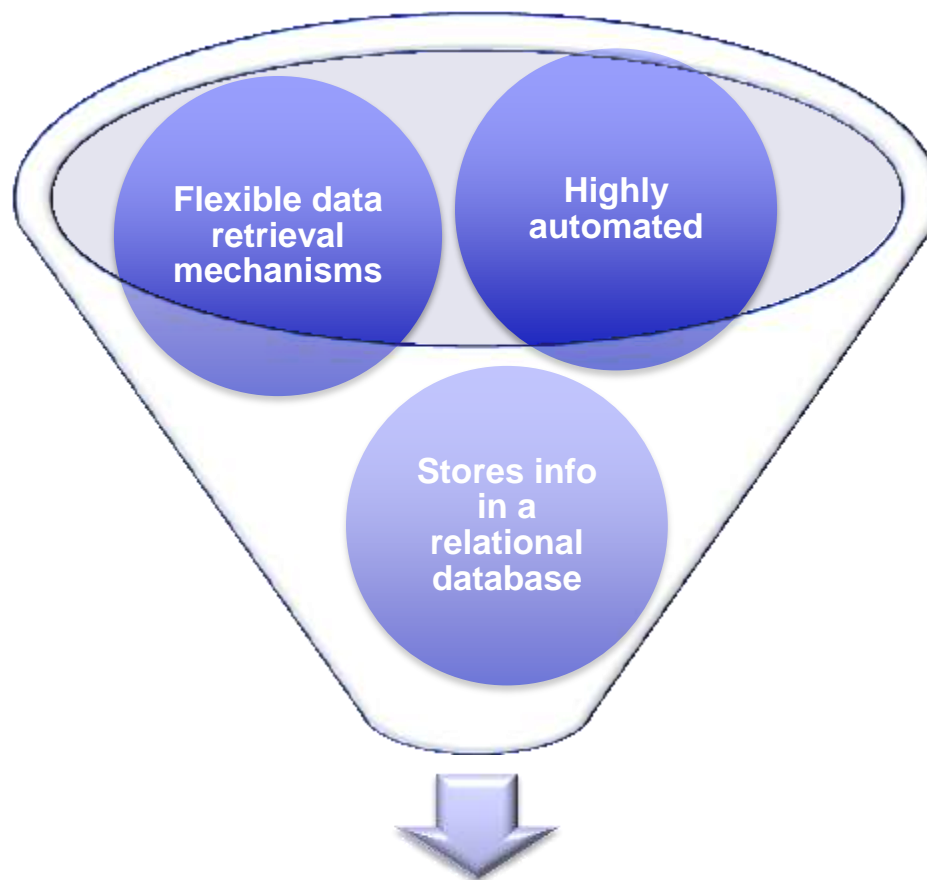➡ Repository for spectroradiometer data and associated metadata

➡ Java-based application – keeps it independent of OS

➡ Runs on any machine with Java Virtual Machine, connects to database via TCP/IP on a configurable port (hence via Web).
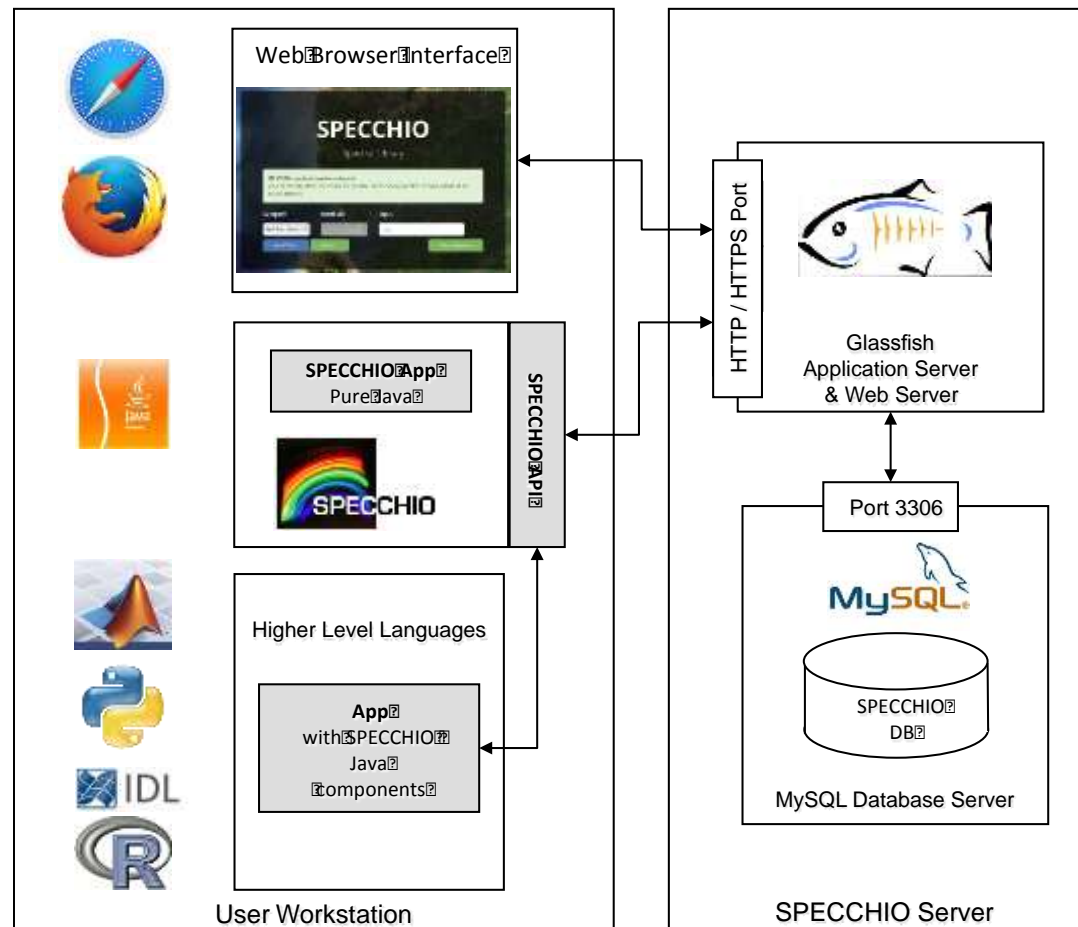
Spectral Database SPECCHIO

Main characteristics:

Spectral database with efficient data import, automated metadata generation, editing and retrieval via a Java app

Spectral Database SPECCHIO

Spectral Database SPECCHIO

Development History

Version 0: 2003 - In-house only

Version 1: 2006 - Java based + Online database. Available to community

Version 2: 2009 - First generic metadata support

Version 3: 2014 - Australian National Data Service project
(SPECCHIO Australia). Full generic metadata support. Open Source

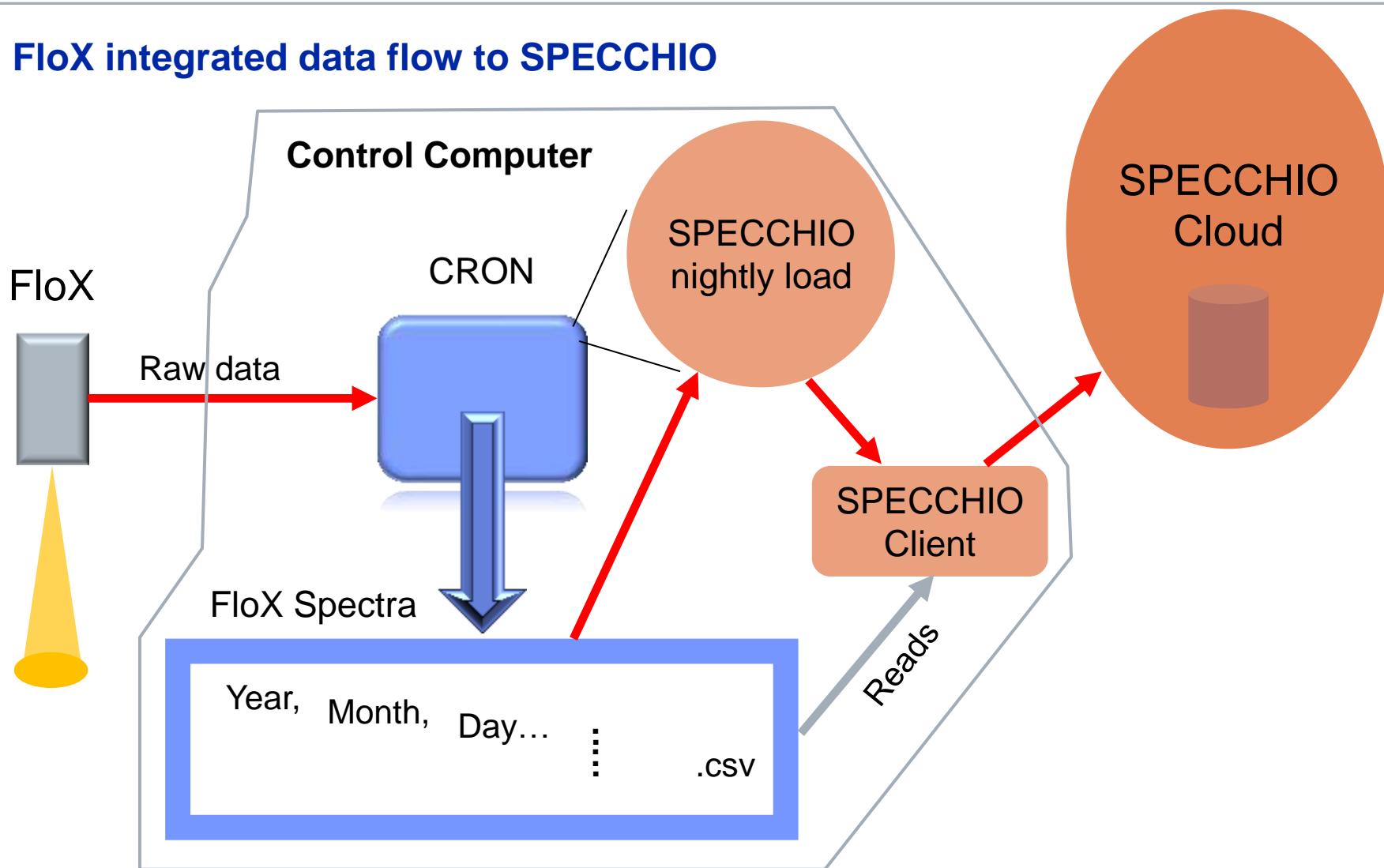**Version 3.3: 2018** - Hosting of SPECCHIO for Australia by
Geoscience Australia (GA). Optimised metadata storage at
hierarchy levels

Australian Government
Geoscience Australia

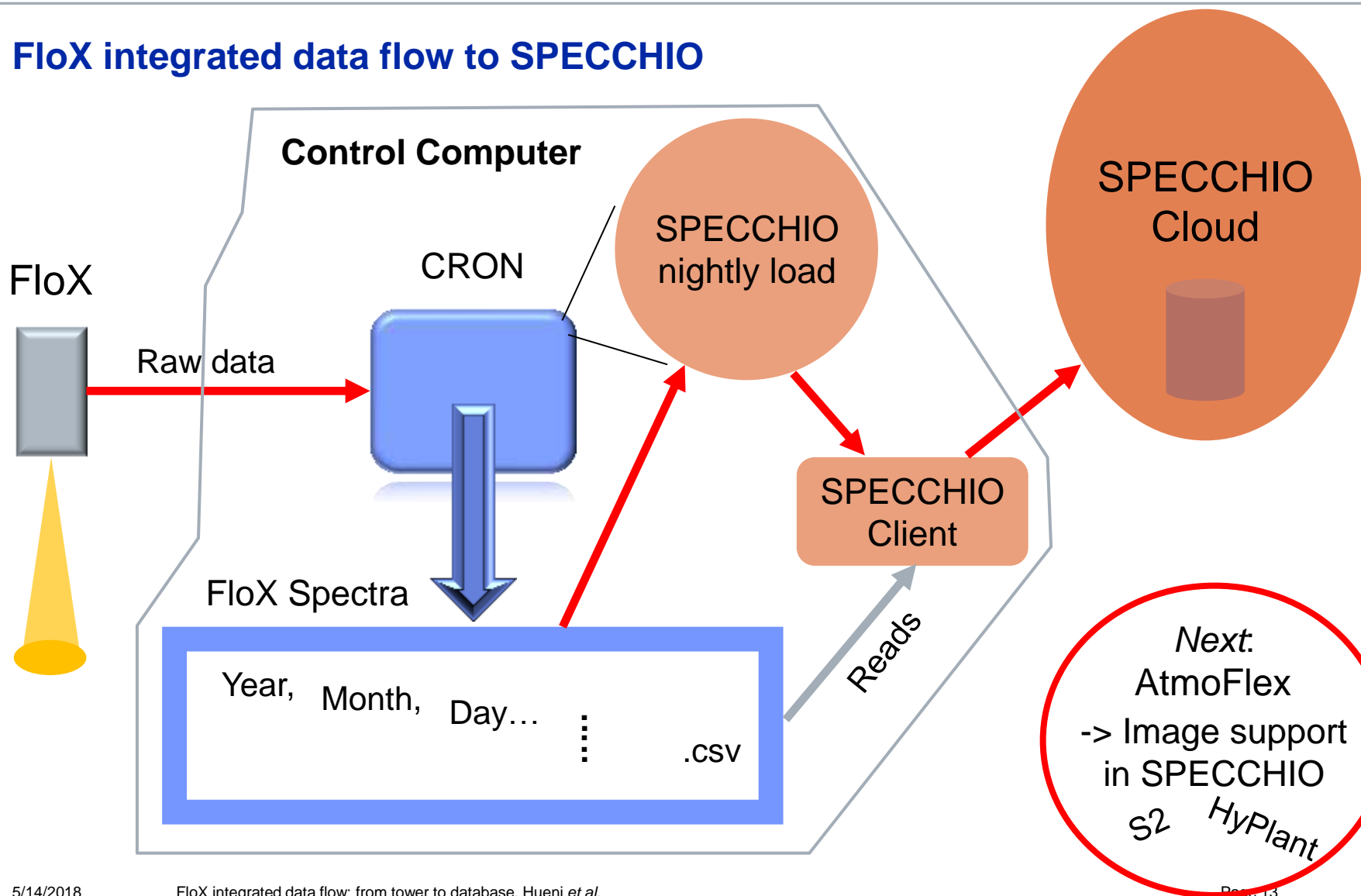Longest development record of any public spectral database in the remote sensing community

FloX integrated data flow to SPECCHIO

Control Computer

FloX

Raw data

CRON

SPECCHIO nightly load

SPECCHIO Cloud

FloX Spectra

Year, Month, Day... ⋮ .csv

SPECCHIO Client

Reads

FloX integrated data flow to SPECCHIO

Control Computer

FloX

Raw data

CRON

SPECCHIO nightly load

SPECCHIO Cloud

FloX Spectra

Year, Month, Day… .csv

SPECCHIO Client

Reads

Next: AtmoFlex -> Image support in SPECCHIO
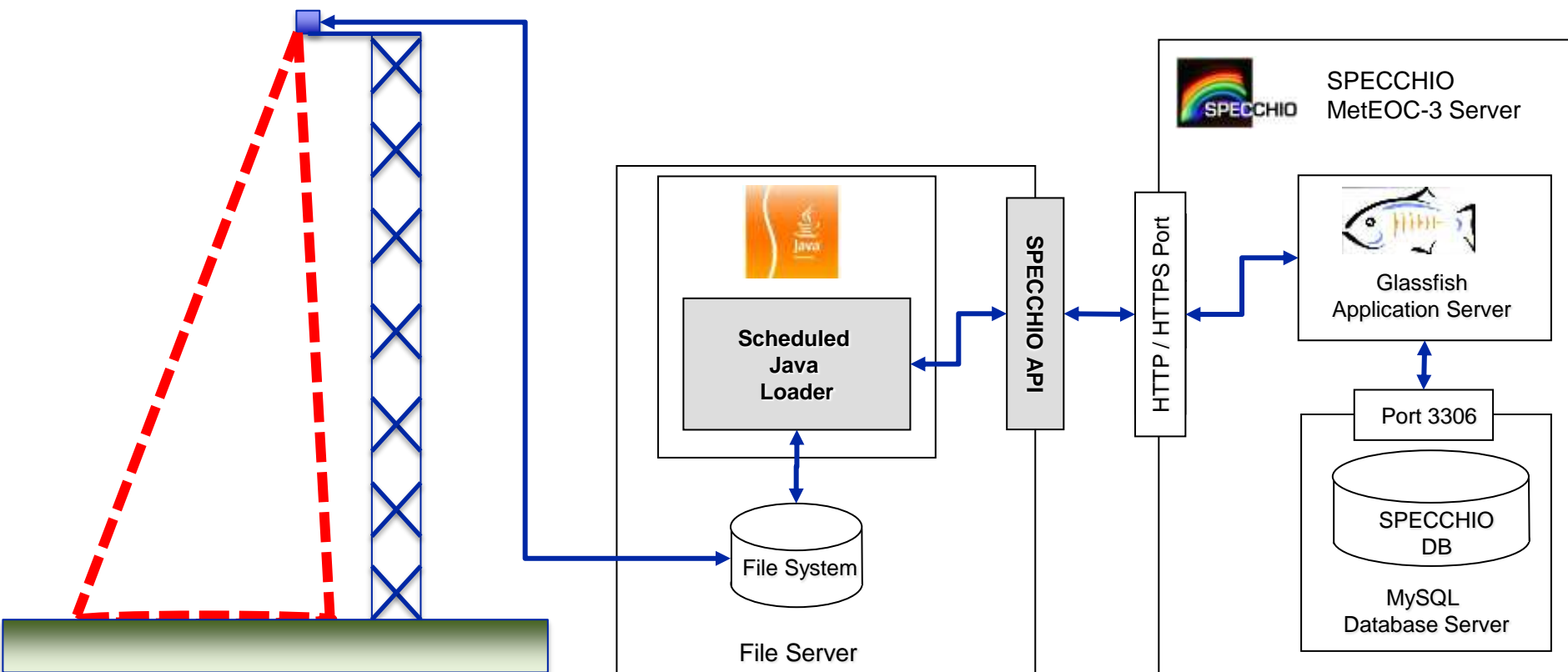
S2 HyPlant

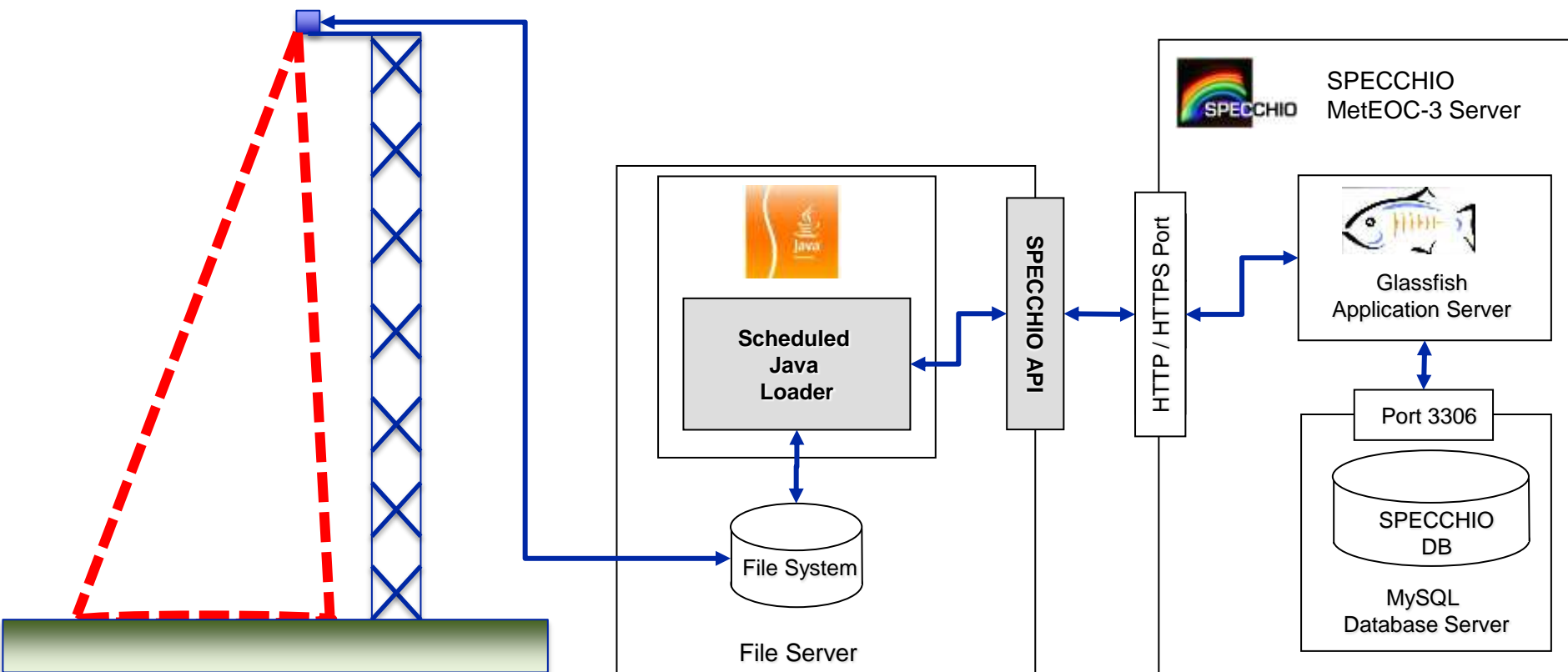FloX integrated data flow: from tower to database, Hueni *et al.*

Use case for the scheduled data loading to SPECCHIO

RadCalNet Gobabeb

Use case for the scheduled data loading to SPECCHIO
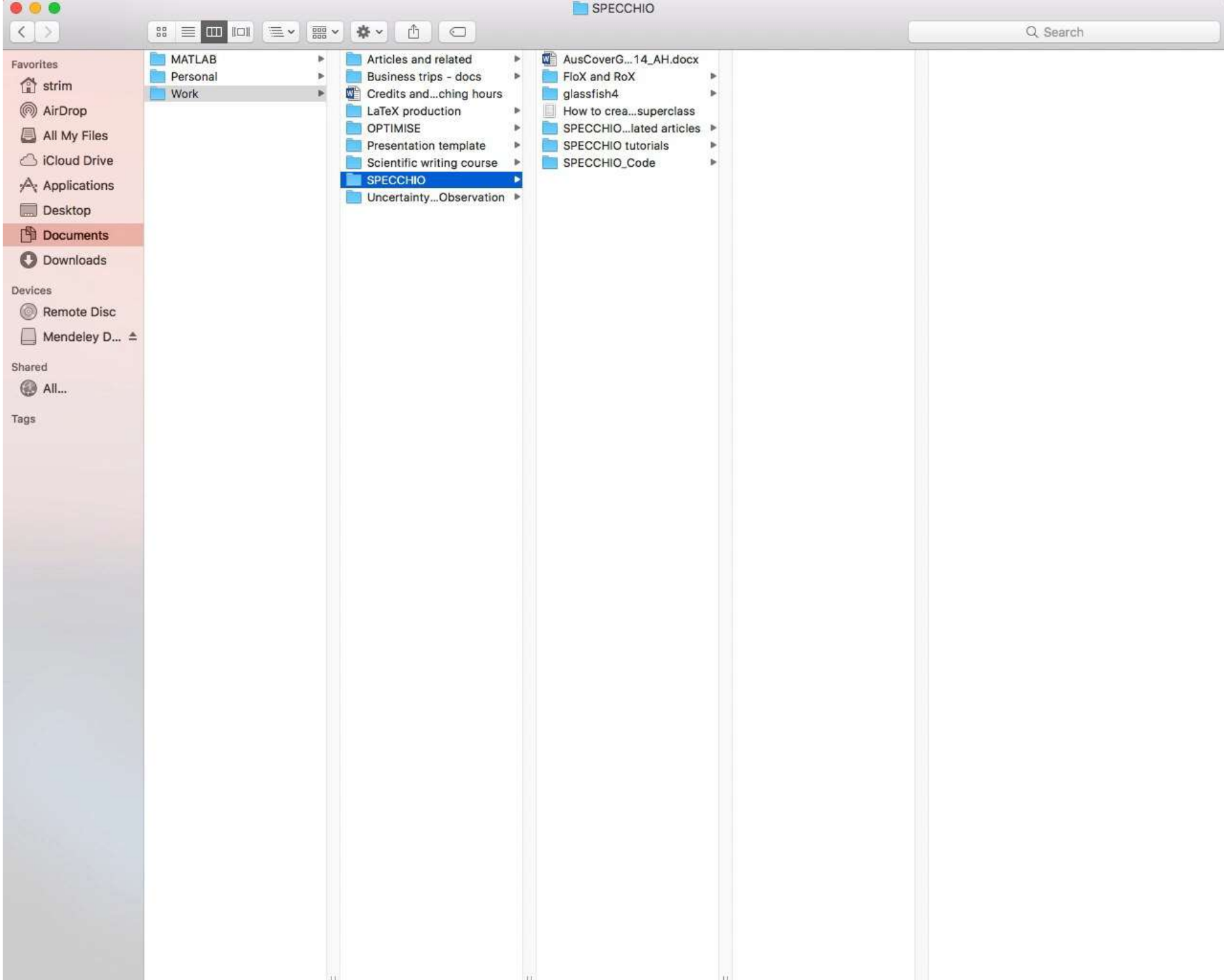
RadCalNet Gobabeb

Use case for the scheduled data loading is online: http://specchio.ch/API_Examples.php

Demonstration: Importing FloX data into SPECCHIO

Q Search

Favorites
- strim
- AirDrop
- All My Files
- iCloud Drive
- Applications
- Desktop
- Documents
- Downloads

Devices
- Remote Disc
- Mendeley D... ⏏

Shared
- All...

Tags

MATLAB ▶	Articles and related ▶	AusCoverG...14_AH.docx
Personal ▶	Business trips - docs ▶	FloX and RoX ▶
Work ▶	Credits and...ching hours	glassfish4 ▶
	LaTeX production ▶	How to crea...superclass
	OPTIMISE ▶	SPECCHIO...lated articles ▶
	Presentation template ▶	SPECCHIO tutorials ▶
	Scientific writing course ▶	SPECCHIO_Code ▶
	SPECCHIO ▶	
	Uncertainty...Observation ▶	

Further case study: User-friendly FloX interface
(RSL, University of Applied Sciences and Arts Northwestern Switzerland)

Demonstrate the potential of streamlined graphical user interfaces

Java application to interface with FloX/RoX field spectroradiometers and manage spectral data imported from their SD storage cards:
FloX/RoX Visualization Application (FRVA)
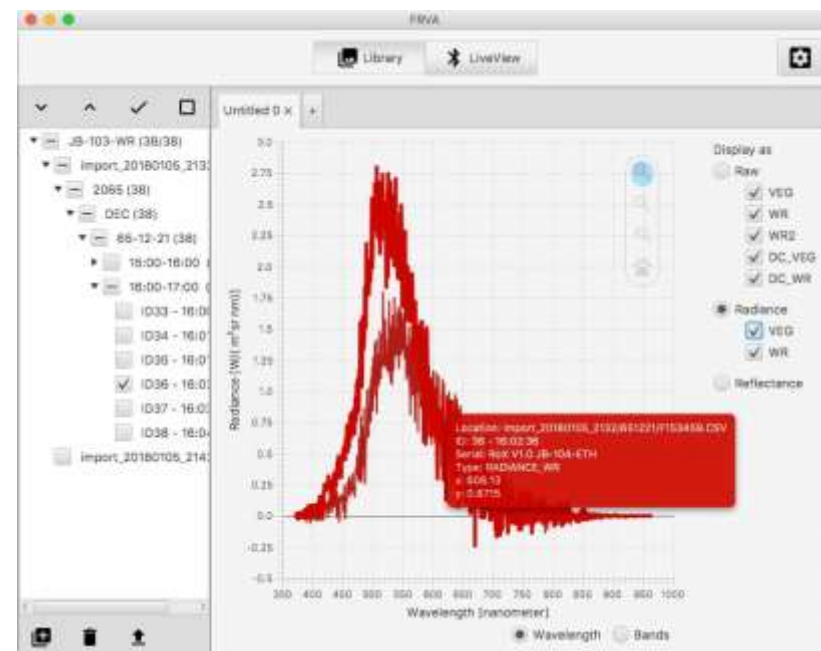
FRVA showing stored radiance values of upward and downward looking channels acquired under low light conditions (*A. Hueni et al., 2018*)

Further case study: User-friendly FloX interface
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Demonstrate the potential of streamlined graphical user interfaces

Java application to interface with FloX/RoX field spectroradiometers and manage spectral data imported from their SD storage cards:
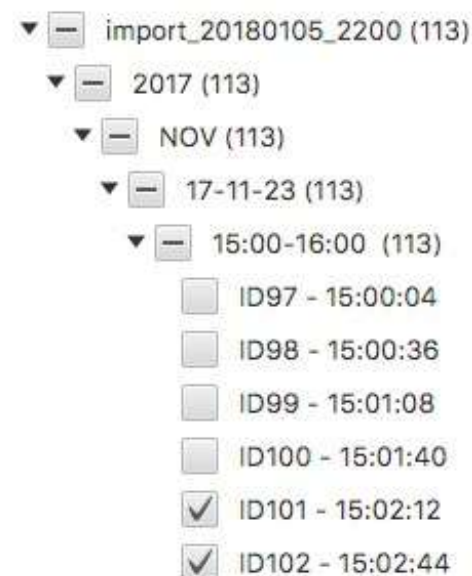*FloX/RoX Visualization Application (FRVA)*

Example of a hierarchy as shown by the FRVA (*A. Hueni et al., 2018*)

Further case study: User-friendly FloX interface
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➡ Demonstrate the potential of streamlined graphical user interfaces

Code and compiled binaries are freely available on GitHub:
https://github.com/jpduloch/frva

➡ Java application to interface with FloX/RoX field spectroradiometers and manage spectral data imported from their SD storage cards:
FloX/RoX Visualization Application (FRVA)

FLEX: Background

Main challenge for calibration/validation

Lab and Field vegetation fluorescence measurement techniques
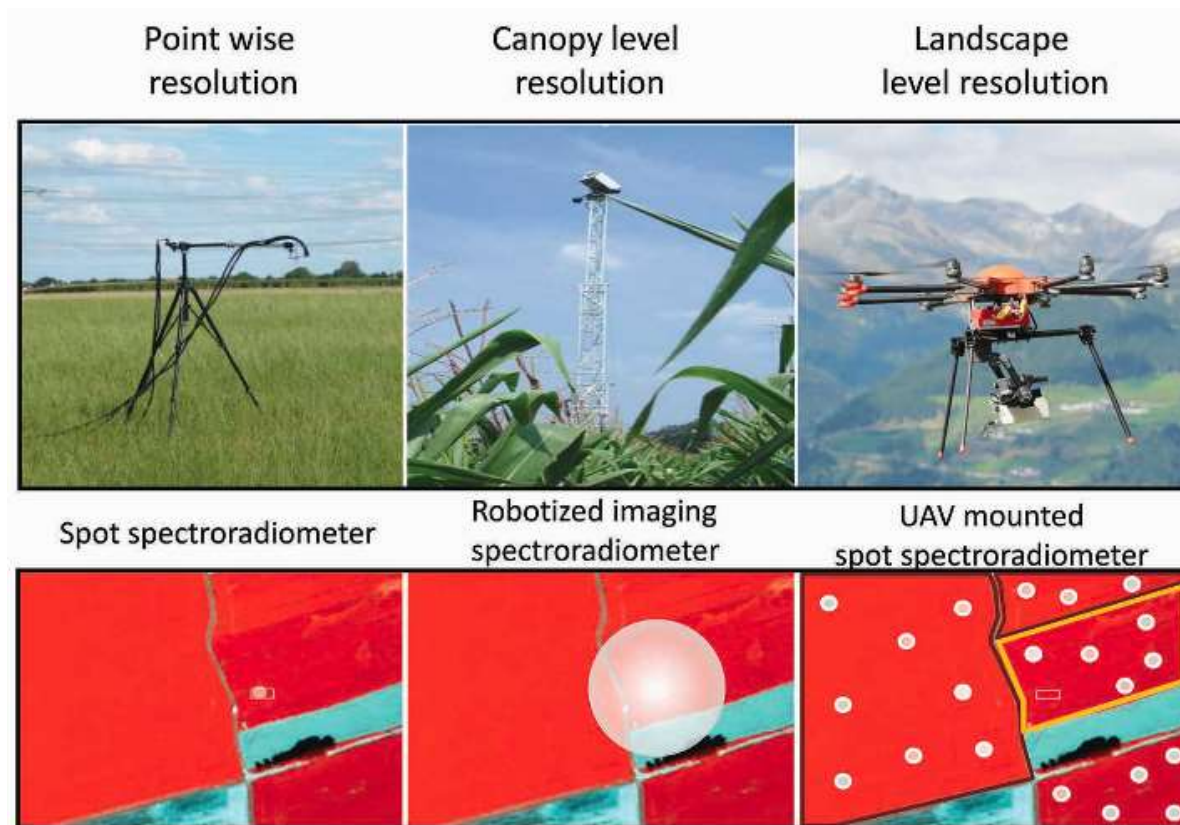
adapt into →

Remote sensing systems operated from aircraft and satellites

New ability:
mapping of photosynthetic efficiencies over large geographical areas
(ultimately global scale)

FLEX: Background

Any EO mission requires land-based and airborne measurements to validate satellite data

ESA, SP-1330/2 (Figure 6.7, June 2015)
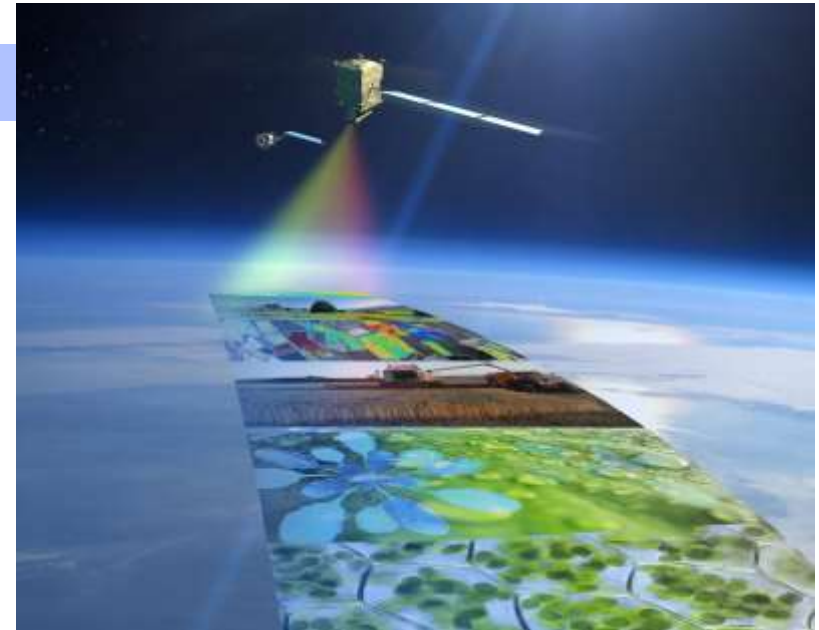
AtmoFLEX: Framework and Goals

FLEX: FLuorescence EXplorer

ESA's 8th Earth Explorer mission

AtmoFLEX campaign

Supporting science study
for FLEX

ESA

→ Use **FloX** instruments to make a **reference network** of equally-equipped sites

→ Establish a **reference database for FLEX-related projects** (incl. Sentinel-3)

Recap and Outlook

As of now, one can already import FloX/RoX .csv files into SPECCHIO

Remaining tasks for automated data flow: generate time-structured folders to copy over daily data from tower sites, calibration data + remaining metadata parameters

FLEX challenge: like every EO mission, combine in situ ground data (here: FloX) with satellite products for calibration and validation

This database might be interesting for AtmoFlex!

Not covered: processing of the data to radiance or fluorescence BUT option to integrate the processing module within SPECCHIO in the future

Thank you for your attention

SPECCHIO website: www.specchio.ch

FLEX: Background

General interest in developing new abilities to acquire further insight into Earth-system processes…

… including photosynthesis

➡ Most information about terrestrial vegetation obtained from reflectance alone

➡ **BUT** emitted radiation (spectral fluorescence) can be used to identify the dynamical status of vegetation (stress)

Fluorescence: the most directly measurable indicator for photosynthetic efficiency

➡ **Interest in remote sensing of fluorescence**

Kernfarben

	Blau	Grau	Ockerrot
100%	0R 40G 165B	163R 173G 183B	220R 96G 39B
80%	51R 83G 183B	181R 189G 197B	227R 128G 82B
60%	102R 126G 201B	200R 206G 212B	234R 160G 125B
40%	153R 169G 219B	218R 222G 226B	241R 191G 169B
20%	204R 212G 237B	237R 239G 241B	248R 223G 212B

5/14/2018   UZH-Farbpalette

Ergänzungsfarben

	Türkis	Flaschengrün	Lindengrün	Warmgelb
100%	11R 130G 160B	42R 127G 98B	145R 195G 74B	254R 222G 0B
80%	60R 159G 182B	86R 157G 133B	170R 212G 112B	251R 230G 81B
60%	107R 183G 199B	128R 182G 164B	191R 223G 148B	252R 236G 124B
40%	158R 208G 217B	171R 206G 194B	213R 233G 183B	253R 243G 168B
20%	207R 232G 236B	213R 231G 225B	234R 244G 219B	254R 249B 211B