JEDI Skylab Observation Evaluation for Emerging Sensors

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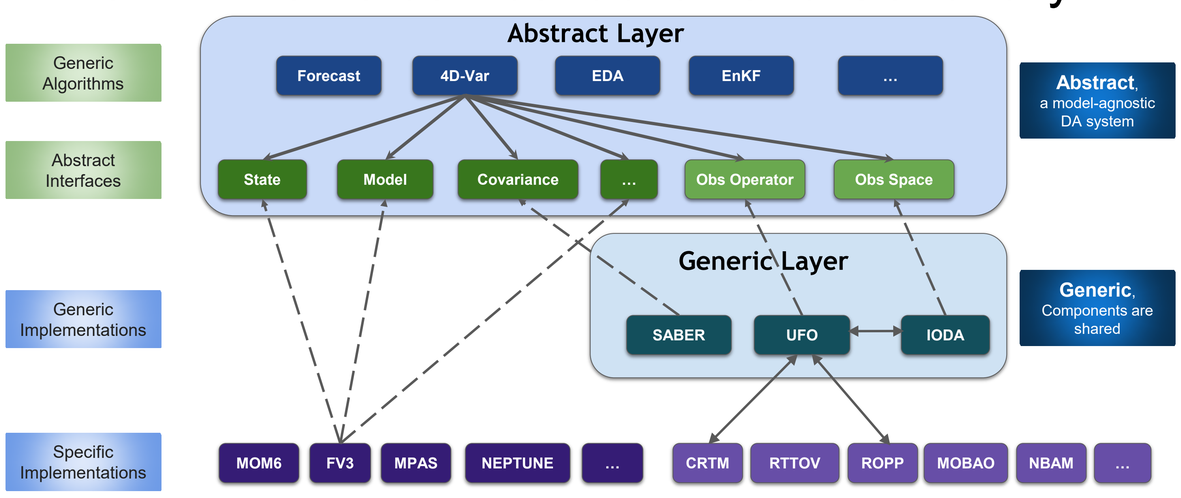
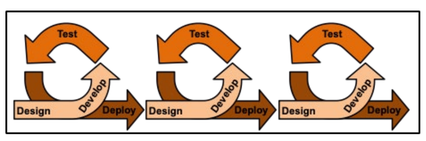
What is JEDI?

The Joint Center for Satellite Data Assimilation (JCSDA) is an interagency partnership to enable research for applying satellite data and research to operational goals in environmental analysis and prediction. One of the JCSDA projects is the Joint Effort for Data Assimilation Integration (JEDI). JEDI scientists and software engineers work to provide a unified data assimilation framework for research and operational use for different components of the Earth system and various applications. This project's main objective is to reduce or avoid redundant work within the community, increase the efficiency of research, and assist in the transition from development teams to operational use. The JEDI framework is designed to accelerate and improve the quantitative use of research and operational satellite data in weather, ocean, climate and environmental analysis and prediction systems.

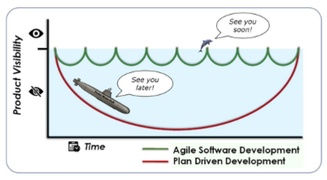
JEDI Promotes Abstraction and Genericity





Agile testing

- Continuous process, feedback for each iteration
- Issues are fixed within the same iteration
- Easier to review



Unified Forward Operator

Implementation for Small Satellites

The JEDI system is designed to easily implement new and emerging observations, including methods of quality control, and how to specify observation error. This generic component is called the Unified Forward Operator (UFO). By abstraction of the model interfaces the observation object can be passed to different observation operators, for the observations shown here, we are using the JCSDA CRTM. The flexibility of the system allows for testing of different filters, error assignments and other DA methods readily.

TEMPEST

Channel	Frequency	Proxies
1	89	ATMS, MHS, MWHS-2
2	165	
3	176	
4	180	
5	182	

COWVR (12 channels, full stokes)

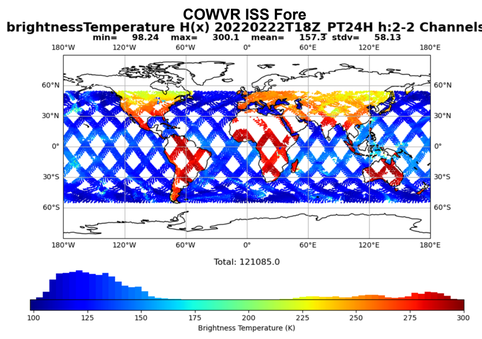
Channel	Frequency (V, H, S_3, S_4)	Proxies
1-4	18.7	Windsat
5-8	23.8	
9-12	33.9	

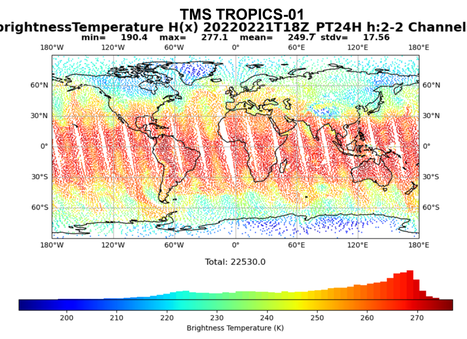
TROPICS

Channel	Frequency	Proxies
1	91.66	ATMS, MHS, MWHS-2
2	114.5	
3	115.95	
4	116.65	
5	117.25	
6	117.8	
7	118.24	
8	118.58	
9	184.41±1	
10	186.51±1	
11	190.31±1	
12	204.8±1	

SmallSat Evaluation

One of the core functions of the JCSDA is to explore new and emerging data sources by developing strategies for quality control and assimilation for the benefit of the partner agencies. A series of diagnostics in observation space have been created including maps, mean bias and standard deviation of the first-guess departures, and time series and zonal averages of the departures. These all allow both detection of anomalies in space and time.

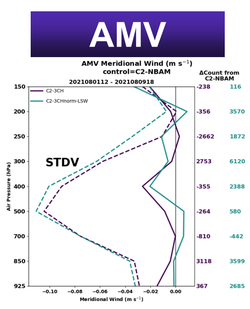




Fit-to-Observations

The JEDI diagnostic suite includes the ability to produce differences between the experiment fits (e.g. first-guess departures) to other observation types. The change in the standard deviation and/or bias allows determination of improvement and degradation of the experimental configuration.

AMV



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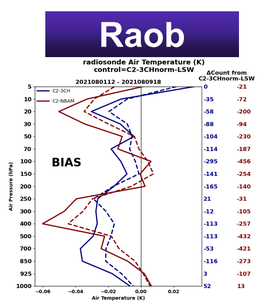
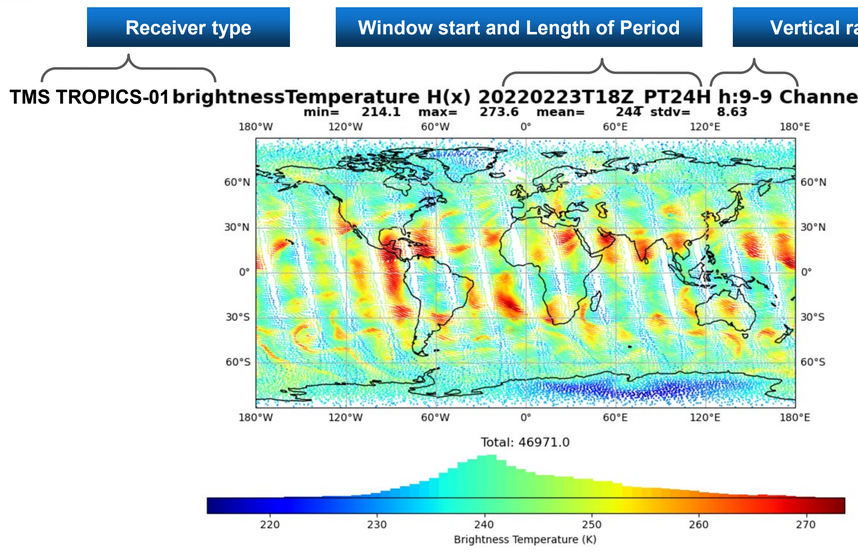


Monitoring

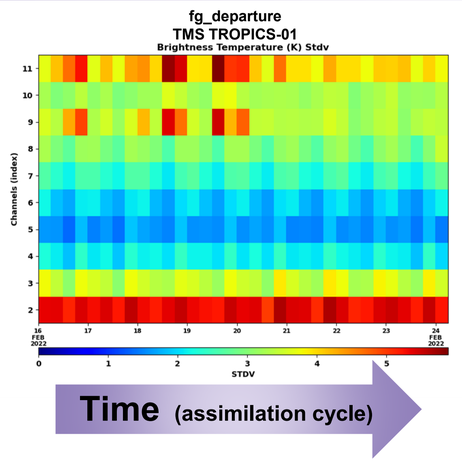
Flexible visualization for GNSS-RO

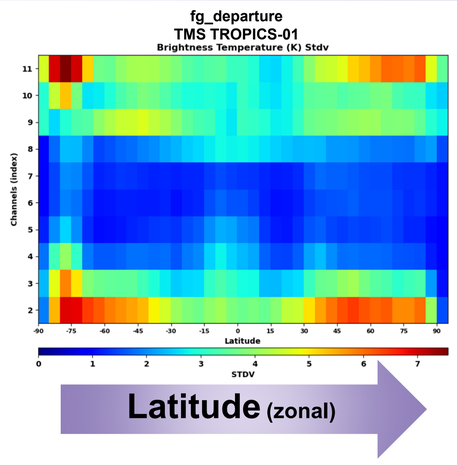
The observation output with first-guess and analysis departures, quality control decisions and observation error assignments are contained in the observation space and can be output using the Interface for Observation Data Access (IODA). Using this common framework a generic set of visualizations can be designed with the capability to examine the observations in a variety of specialized ways and move toward dynamic visualization.



Summarize

Statistics calculated over different dimensions such as time, or location can diagnose trends and detect irregularities or systematic patterns. The ability to summarize over the dimensions can then be reported and/or addressed in the assimilation system.





Exploration

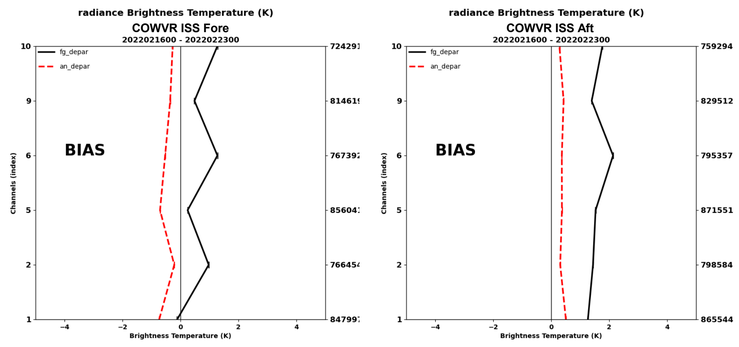
Diagnose observations across meta data

The Interface for Observation Data Access (IODA), contains vital MetaData information which can readily be used for monitoring or even filtering in the assimilation. Discussions with the COWVR calibration and validation team led to a recommendation to use the fore and aft looks as separate sensors for independent errors and bias correction.

Discover

The yaml driven framework in JEDI allows for COWVR fore and aft looks to straightforwardly be treated as separate sensors.

COWVR Fore or Aft



JEDI Skylab Demonstration

The JEDI Skylab system is an evolving framework for demonstrating new and emerging technologies. JEDI Skylab v1 was released Aug2022, and has been followed by quarterly releases with Skylab v4 to be released in Apr2023. The growing capabilities of the system include an ensemble data assimilation system. The bias correction for these sensors was spun-up from the study time period and initially begun with just the constant offset term.