Integrating Software and Hardware for New Observing Strategies

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What does the future look like?

- Future satellite sensing missions will most likely include adaptive sensors working with resource constraints and in collaborating constellations.
- Hardware already has these attributes/capabilities.
- Science gains: better data quality, avoiding recording/storing useless data, rapid response to events, “synoptic” observation capability.

- All extend the traditional “fixed sensor” paradigm that our community is used to and comfortable with.
  - Can we accept decisions about data acquisition being made autonomously? Key challenge is the perception of risk.
CubeRRT Example

• Radio Frequency Interference (RFI) processor aboard the CubeSat Radiometer RFI technology validation (CubeRRT) mission autonomously flags and removes RFI from microwave radiometer observations.

• Previously this had been performed on the ground at cost of greatly increased downlink bandwidth.
  • Due to perception of risk in discarding potentially useful data.

• CubeRRT RFI filtering is an “algorithmic” method that implements processing similar to that on the ground aboard the satellite.

• This technology is essential for future Earth observing microwave radiometers given the increasing presence of RFI.
  • We may not have a choice as to whether to allow on-board decision making!
Addressing Risk

• As with any mission prep, we should take steps from mission simulations to ground or airborne demonstrations to space testing to full scale mission
  • A “full scale” mission here may be a constellation of distributed CubeSats with differing sensor sets

• OSU AIST project is developing the STARS library to facilitate mission simulations
  • Case studies show advantages of new strategies

• ESTO’s New Observing Strategies Testbed an important step for additional demonstrations blending software and hardware capabilities
Next Steps

- Continue building community awareness of capabilities of hardware/software in achieving
  - Sensor adaptation
  - Resource management
  - Collaborating constellations and systems
  - Autonomous decision making

- Continue simulations and demonstrations of New Observing Strategy systems
  - Intelligent Earth Observation Network proposed as a Design Reference Mission (DRM)

- Build interactions with science community
  - Atmospheric applications seems like a good first target
    - Experiences rapid change that is of high science interest
    - A+CCP mission formulation ongoing