Tom Hamill notes on ClimaCell's proposed satellite concept.

Category	**PRO**	**CON**
Precipitation measurement.	If accurate enough, they are of interest to prediction centers for improving precipitation analyses for statistical postprocessing and forecast model validation. Particular positive impact in data-sparse areas, e.g., Alaska, northern Columbia River Basin. And developing countries.	With more accurate ERA5 reanalyses and the underlying models used to provide background forecasts, products like MSWEP are getting more accurate in the absence of remotely sensed precipitation. Hence possible decreased importance of remotely sensed observations with DA / reanalysis improvements.
Precipitation rate data assimilation.	With substantial numbers of precipitation rate observations, these data should have impact on shorter-lead precipitation forecasts through assimilation of data, improved initial conditions. Relevant references include here. Some possible synergies between coincident precipitation rate and AMSUA-type instruments, helping to better estimate forward operator for cloudy precipitating fields of view.	Precipitation measurements are challenging to assimilate correctly, for most assimilation schemes have linear error evolution and Gaussian assumptions underlying them, and precipitation is non-Gaussian with point mass at zero. Algorithmic remedies like particle filters are still maturing and computationally expensive. Relevant references here, here, Main observation impact is still from microwave and infrared radiometer sounding instruments like AMSUA & IASI that define thermodynamic structure. Relevant reference here. DA community is urging evolution away from retrievals to assimilation of raw data, which then means relevant model forward operator must be developed in order for centers to embrace operational DA. This forward

		operator development takes time. See summary of retrieval DA vs. raw measurement DA (here, p. 18). This would add a level of delay to rapid operational use. See WMO DA impact report here, rec 14, p. 7.
Ocean surface winds	Some history of their use in data assimilation, e.g., here, here. Proven technology with modest positive impact, especially when multiple scatterometer (C-band ASCAT, OSCAT [Indian KU-band]) assimilated.	I believe (?) there are still confounding issues of surface wind estimation in columns with significant liquid water path. Or so literature circa 2010 indicated.
HIWRAP-type wind profile	Relative data void currently for wind observations in regions obscured by high clouds, so this fills one of the known data voids. Potentially a complement to European ADM EOLUS wind lidar, primarily clear sky and non-stormy regions of less meteorological significance.	Wind observations provided only in cloudy and precipitating regions, a fraction of the earth at any given time. Some overlap in capability with cloud-drift winds, though HIWRAP presumably can see through upper clouds in a way that cloud-drift technology cannot. Probably better in synoptic-scale ascent rather than in thunderstorm-type environments; in convective regions, mesoscale variability across 5-km footprint.
Ocean surface currents.	In conjunction with ocean surface winds, allows determination of air-ocean cross covariances and provides data for flux estimation, which are useful in coupled prediction (for testing coupled processes) and coupled data assimilation.	At northern latitudes, 5 km footprint is near the scale of eddies.
Other ocean observations	In general, useful for ocean	NOAA will need education on

(sea-surface height, ocean wave height)	and coupled ocean-atmosphere DA, for validation of coupled forecasts. Wave heights useful for wave prediction systems at weather prediction facilities.	and demonstration of value and accuracy of these observations to embrace these. Its own development activities in OAR lean toward in-situ measurements, which are more expensive per observation and require more human intervention.
Snow depth (KaIA?) Could not find literature via Google search on this	If as accurate as NASA's Airborne Snow Observatory, could be very valuable to prediction centers and stakeholders such as California Dept of Water Resources for snow depth estimation, which is critical for hydrologic prediction. Airborne Snow Observatory is expensive to operate.	Footprint 250m x 5 km? Snow depth is very elevation dependent and thus may exhibit sub-grid variability. Is estimation of snow depth possible in forested areas? These areas are important to hydrologists, for the majority of snow pack falls in these areas.

General questions:

1. Are these instruments proposed for polar-orbiting satellites, geo, other? Will they use existing readout stations near poles (with data-latency issues), or other readout technology? Coordinated with [JPSS ground system] planning yet?
2. Have instrument accuracies been quantified yet? What are they? Value of observations to prediction centers will depend on this.
3. Are you in a risk-reduction phase? Plans such as launching a test satellite, cal/val on that?
4. Have you ensured that you don't have spectrum conflicts with other users? Any chance of interference from other users of those frequencies?
5. Are you prepping now for rapid cal-val once data stream starts? Consulted NESDIS, EUMETNET, others on what they want to see in the way of evidence? Provide sample data to relevant agencies?
6. DA *H* "forward" operators ready?
7. Switching OS modalities - are all instruments observing simultaneously, or one at a time? If the latter, do you have automated procedures ready for taking the most valuable observations? Will they be based on weather (e.g., cloud/no cloud) primarily, or customer requests? What if there are competing requests for different data (e.g., weather needs conflict with customer requests) ?
8. Are you planning linkages with other parts of the business, e.g., hyper-local forecasts, statistical postprocessing?