DS Science Question	Applications thematic Areas	Enabled Applications	Decision Approach	End User	Most Relevant Geophysical Variables	Most Relevant Observables	ACCP Novelty (new GV or Observable)	ACCP Continuity (similar to POR GV/Observable)	ACCP Goal
S-4a Quantify global, decadal landscape change produced by abrupt events and by continuous reshaping of Earth's surface due to surface processes, tectonics, and societal activity. (Recommended measurement of rainfall and snowfall rates).	Disaster Monitoring and Modeling	Disaster modeling: Volcanic plume, smoke aerosol vertical distribution and extent for transport modeling, aviation, public health	Apply cloud and aerosol products to monitor and track aviation hazards and public health risks.	NOAA, FAA, NCAR, VAACs, private aviation weather forecasting companies, airlines	Aerosol Type, Aerosol Extinction, Aerosol Optical Depth, Cloud Extinction, Cloud Optical Depth	Cloud and Aerosol Profiles, Cloud Mask	Aerosol Type	Cloud and Aerosol Optical Depths, Cloud and Aerosol Profiles, Cloud Mask	G4 Aerosol Processes Reduce Uncertainty in key processes that link aerosols to weather, climate and air quality related impacts
H-1b Quantify rates of precipitation and its phase (rain and snow/ice) worldwide at convective and orographic scales suitable to capture flash floods and beyond.	Disaster Monitoring and Modeling	Disaster monitoring and modeling: flood, landslide, post-fire debris flow	Use of precipitation intensities and accumulation for modeling conditions that cause floods, landslides, and debris flows	Government, Private modeling companies, operational forecast centers	Precipitation rate, 2D @surface			Precipitation rate, 2D @surface	G2 Storm Dynamics: Improve our physical understanding and model representations of cloud, precipitation and dynamical processes within storms
H-1b Quantify rates of precipitation and its phase (rain and snow/ice) worldwide at convective and orographic scales suitable to capture flash floods and beyond.	Disaster Monitoring and Modeling	Disaster risk: Parametric and risk modeling (Reinsurance, microinsurance)	Use of precipitation time series for parametric modeling to inform payouts and insurance pricing	Reinsurance, insurance and microinsurance industries	Precipitation rate, 2D @surface			Precipitation rate, 2D @surface	G2 Storm Dynamics: Improve our physical understanding and model representations of cloud, precipitation and dynamical processes within storms
W-5a Improve the understanding of the processes that determine air pollution distributions and aid estimation of global air pollution impacts on human health and ecosystems by reducing uncertainty of vertically resolved tropospheric fields (including surface concentrations) of speciated PM, O3, and NO2.	Health (Public and Ecosystem) and Air Quality	AQ Rule and Regulation Making: Determining patterns of air pollution exposure to determine impacts of regulations, areas that need greater monitoring efforts, conduct source apportionment	Use aerosol and aerosol precursor emissions, including aerosol-type speciation; attribute and track plume transport; determine spatio-temporal variations of PM, including PM type, for exceptional event exceptions and to monitor and set Rules and Regulations	EPA, state AQ agencies, international AQ agencies, legislatures (e.g., California A.B. 617)	Aerosol Type, Aerosol Extinction, Aerosol Optical Depth, Cloud Mask, and cloud and aerosol profiles	These stakeholders might not have the expertise to create the 2D surface particulate matter concentration L4 product (that they require) from relevant observables.	Near-surface vertical aerosol distribution AND speciated aerosol-type/ PM products	Aerosol distribution	G4 Aerosol Processes Reduce Uncertainty in key processes that link aerosols to weather, climate and air quality related impacts
W-5a Improve the understanding of the processes that determine air pollution distributions and aid estimation of global air pollution impacts on human health and ecosystems by reducing uncertainty of vertically resolved tropospheric fields (including surface concentrations) of speciated PM, O3, and NO2.	Health (Public and Ecosystem) and Air Quality	Estimating air pollution: exposure and impact on health outcomes to assess health risks	Apply L4 vertical and horizontal surface PM data to determine spatio-temporal patterns of exposure.	CDC, WHO, NIH, health researchers at universities/hospitals (e.g., Global Burden of Disease), nonprofits and environmental justice groups	Aerosol Extinction Profile, Aerosol-Cloud Feature Mask (Profile), Aerosol Optical Depth, Aerosol Number Concentration	Many of these stakeholders will likely not have the expertise to create the L4 product (that they require) from relevant observables.	First global high-resolution (spatial and temporal) satellite-derived speciated PM datasets	Aerosol distribution	G4 Aerosol Processes Reduce Uncertainty in key processes that link aerosols to weather, climate and air quality related impacts
H-3 How do changes in the water cycle impact local and regional freshwater availability, alter the biotic life of streams, and affect ecosystems and the services these provide?	Health (Public and Ecosystem) and Air Quality	Health and Ecological Forecasting/Monitoring: Vector- and water-borne disease monitoring/modeling (e.g. malaria).	Models combining precipitation accumulation and anomalies, soil moisture, land cover, and temperature, along with other environmental variables to identify breeding areas for vector-borne diseases and inform where water-borne diseases may develop and spread (e.g. cholera and other diarrheal diseases). Improve the prediction and severity of outbreaks.	DOD Health Agency, FEMA, UNICEF, Epidemico, DHS, Pandemic Prediction and Forecasting Science and Technology, USDA, CDC, PAHO, CONAE	Precipitation rate, 2D @surface			Precipitation rate, 2D @surface	G4 Aerosol Processes Reduce Uncertainty in key processes that link aerosols to weather, climate and air quality related impacts
W-5a Improve the understanding of the processes that determine air pollution distributions and aid estimation of global air pollution impacts on human health and ecosystems by reducing uncertainty of vertically resolved tropospheric fields (including surface concentrations) of speciated PM, O3, and NO2.	Health (Public and Ecosystem) and Air Quality	Health insurance and reinsurance, e.g., pollution exposure risks	Apply L4 horizontal and vertical surface PM data to determine spatio-temporal patterns of exposure.	reinsurance industry (e.g., SwissRE), health insurance industry	2D surface particulate matter concentrations, Aerosol Extinction Profile, Aerosol-Cloud Feature Mask (Profile), Aerosol Optical Depth, Aerosol Number Concentration	These stakeholders will likely not have the expertise to create the L4 product (that they require) from relevant observables.	First global high-resolution (spatial and temporal) satellite-derived speciated PM datasets	Aerosol Optical Depth	G4 Aerosol Processes Reduce Uncertainty in key processes that link aerosols to weather, climate and air quality related impacts
W-5a Improve the understanding of the processes that determine air pollution distributions and aid estimation of global air pollution impacts on human health and ecosystems by reducing uncertainty of vertically resolved tropospheric fields (including surface concentrations) of speciated PM, O3, and NO2.	Health (Public and Ecosystem) and Air Quality	Operational Air Quality Forecasting: Air Quality Alerting and monitoring for extreme air quality events	Use AQ forecasts with ground-based data to issue AQ alerts and identify AQ events that will likely have an acute impact on human health: e.g., wildfires, dust. Use satellite data for model validation as well as improving simulation of aerosol processes.	Federal (NOAA, EPA) and state AQ agencies , public and private companies, nonprofits and environmental justice groups	Aerosol Extinction Profile, Aerosol-Cloud Feature Mask (Profile), Aerosol Optical Depth, Aerosol Number Concentration	Extinction profiles, multiangle radiance and polarization parameters	Vertical aerosol distribution AND Aerosol PM2.5 Concentration	Aerosol Optical Depth	G4 Aerosol Processes Reduce Uncertainty in key processes that link aerosols to weather, climate and air quality related impacts
S-7 How do we improve discovery and management of energy, mineral, and soil resources?	Infrastructure and Development	Energy Planning: Estimate radiative fluxes for solar insolation (e.g., rainfall over time to deposition of acidic aerosols, dust/aerosol warnings/ forecast to rotate/close panels). Estimate wind availability for wind energy production.	Aiding solar power companies to estimate solar insolation in various environments and to estimate solar panel efficiency and degradation over time (also estimation of deposition rate of aerosols, including dust, onto solar panels). Provide data for precipitation amounts, wind direction and speed for siting and maintaining wind farms for sustainable wind energy production.	NWS, NOAA, CTM, EPA, state AQ agencies, other modeling communities; solar power companies and entities wishing to invest in solar power, such as city governments	Aeral Cloud Fraction, Radiative Fluxes, Precipitation Rate 2D@ surface, Aerosol Number Concentration, Aerosol Extinction Profile, Aerosol Optical Depth		Vertical Aerosol Distribution	Aerosol Optical Depth	G4 Aerosol Processes Reduce Uncertainty in key processes that link aerosols to weather, climate and air quality related impacts
C-2a Reduce uncertainty in low and high cloud feedback.	Infrastructure and Development	Energy Planning: Hydropower potential and modeling	Use of rainfall data to estimate water volumes for lakes or watersheds	Private Agriculture companies, NGOs, World Bank	Precipitation rate, 2D @surface	radar reflectivity, microwave brightness temperatures		Precipitation rate, 2D @surface	G1 Cloud Feedback: Reduce the uncertainty in low- and high-cloud climate feedbacks by advancing out ability to predict the properties of low and high clouds
H-1b Quantify rates of precipitation and its phase (rain and snow/ice) worldwide at convective and orographic scales suitable to capture flash floods and beyond.	Infrastructure and Development	Transportation and logistics: supply chain, road network maintainence, urban planning	Use precipitation data to assess transportation and supply chain concerns	Cargill, MARS, World Food Programme, CONAE, EcoClimaSol, Global Water and Environmental Security Analyst Defense Intelligence Agency (DIA, Pentagon), OXFAM, World Bank GFDRR, FEMA, NGA, State Department	Precipitation rate, 2D @surface , precipition profile, snowfall vertical motion profile	radar reflectivity, doppler motion, mircowave brightness temperature		Precipitation rate, 2D @surface	G3 Cold Cloud and Precipitation Quantify the rate of falling snow at middle to high latitudes to advance understanding of its role in cryospheric-climate feedbacks
W-2a Improve the observed and modeled representation of natural, low-frequency modes of weather/climate variability.	Water Resources	Agricultural modeling and monitoring: Water Resource Management influcing freshwater availability	Use surface precipitation estimates and anomalies to estimate water availability, characterize drought patterns and estimate crop yields for food production	Government agencies, agricultural insurance and precision agriculture, water resource managers	Precipitation rate, 2D @surface	radar reflectivity, microwave brightness temperatures		Precipitation rate, 2D @surface	G2 Storm Dynamics: Improve our physical understanding and model representations of cloud, precipitation and dynamical processes within storms
W-2a Improve the observed and modeled representation of natural, low-frequency modes of weather/climate variability.	Water Resources	Hydrologic Modeling: drought analysis/forecasting for fire weather, agriculture, and ecosystem health	Consider anomalies in long term precipitation accumulations to assess drought severity or potential	USDA Forest Service, Private Agriculture companies, farmers, Timber companies, Perscribed burn associations	Precipitation rate, 2D @surface	radar reflectivity, microwave brightness temperature		Precipitation rate, 2D @surface	G1 Cloud Feedback: Reduce the uncertainty in low- and high-cloud climate feedbacks by advancing out ability to predict the properties of low and high clouds
S-4a Quantify global, decadal landscape change produced by abrupt events and by continuous reshaping of Earth's surface due to surface processes, tectonics, and societal activity. (Recommended measurement of rainfall and snowfall rates).	Water Resources	Hydrologic Modeling: Total water fluxes at watershed including snowmelt, snowcover, and watershed analysis for irrigation	Accumulated precipitation can inform water balance to estimate flow and yields at the watershed scale	Hydropower (e.g. Indonesia Hydro Consult), water managers	Precipitation rate, 2D @surface	radar reflectivity, micorwave brightness temperatures		Precipitation rate, 2D @surface	G3 Cold Cloud and Precipitation Quantify the rate of falling snow at middle to high latitudes to advance understanding of its role in cryospheric-climate feedbacks
C-5a Improve estimates of the emissions of natural and anthropogenic aerosols	Weather, AQ, and Climate Modeling and Forecasting	Aerosol & Precipitation Interactions: Air Quality modeling and forecasting (transport, scavenging, wet deposition, dry deposition, chemical transformation)	Include surface precipitation observations in air quality modeling to account for scavenging, wet deposition and chemical transformation also using observations of transport, dry deposition from PoR	NWS, NOAA, EPA and State Agencies, ECMWF, NRL, JMA	Aerosol Optical Depth, Vertical air velocity profile, Precipitation rate profile, Aerosol Extinction Profile, Aerosol Effective Radius Profile, Cloud Liquid Water Path, Ice Water Path, Aerosol Number Concentration, Precipitation rate at surface, Cloud Droplet Concentration, Precipitation Phase Profile, Precipitation Particle Size Profile	Microwave and IR Brightness Temperatures, UV/VIS reflectance, Attenuated backscatter and depolarization ratio profiles, radar reflectivity	Vertical air velocity profile, Cloud vertical structure, Aerosol extinction profile, Aerosol effective radius profile, Precipitation rate profile / Precipitation rate 2D@ surface,	Aerosol Optical Depth	G4 Aerosol Processes Reduce Uncertainty in key processes that link aerosols to weather, climate and air quality related impacts
W-1a Determine the effects of key boundary layer processes on weather, hydrological, and air quality forecasts at minutes to subseasonal time scales.	Weather, AQ, and Climate Modeling and Forecasting	Air Quality Forecasting: Forecast initialization and verification	Assimilate aerosol extinction and type profiles, and aerosol optical depth retrievals from satellites into operational AQ systems to accurately initialize models; Validate AQ forecasts with satellite data.	Federal (NOAA) and state AQ agencies, EPA, NOAA, NRL, ECMWF, JMA, UKMET, NASA, NCAR, SMC-Canada, Air Force Weather Agency, and NASA GMAO	Aerosol Extinction Profiles, Aerosol Types, Aerosol Optical Depths	Attenuated backscatter and depolarization ratio profiles	Vertical aerosol distribution and speciated products joint lidar and multispectral multiangular polarimeter retrievals	Aerosol Optical Depths CALIPSO-like Aerosol Types	G4 Aerosol Processes Reduce Uncertainty in key processes that link aerosols to weather, climate and air quality related impacts
W-5 What processes determine the spatio-temporal structure of important air pollutants and their concomitant adverse impact on human health, agriculture, and ecosystems?	Weather, AQ, and Climate Modeling and Forecasting	Climate Modeling: Global Climate Smoke Aerosol Transport and Aerosol and Aerosol/Cloud Feedback	Apply cloud and aerosol products to atmospheric models that simulate cloud/aerosol feedbacks		Aerosol Extinction Profile, Aerosol-Cloud Feature Mask (Profile), Aerosol Number Concentration, Aerosol Optical Depth, Aerosol Extinction Profile, Cloud base height, Ice crystal particle size, Ice water path, Latent heating profile water path, Cloud droplet concentration, Cloud optical depth, Cloud Top Height, Cloud top phase, Cloud Top Temperature, Ice crystal number concentration, Total liquid water path				
C-5a Improve estimates of the emissions of natural and anthropogenic aerosols	Weather, AQ, and Climate Modeling and Forecasting	Climate Modeling: Parametrization of clouds, particle distribution for aerosols and precipitation	Include radiative impacts of clouds on aerosols and aerosol on clouds from radiative flux measurements and cloud /aerosol optical properties at cloud aerosol interfaces (also using PoR and DO to augment mission observables)	FEMA, ECMWF, JMA, BOM, UKMET, NASA, NCAR	Aerosol Extinction Profile, Aerosol-Cloud Feature Mask (Profile), Aerosol Optical Depth, Aerosol Number Concentration, Cloud Droplet Effective Radius, Cloud Optical Depth, Cloud Top Droplet Concentration, Cloud Droplet Concentration, Cloud Liquid Water Path , vertical air velocity profile, Precipitation particle size, Precipitation Rate, Ice water path, Radiative heating	Radar Reflectivity, Radiances(VIS,IR), Lidar backscatter, OTHER AEROSOL-related observables	Aerosol effective radius profile, Precipitation rate profile / Precipitation rate 2D@surface, Cloud vertical structure	Vertical and horizontal aerosols, aerosol optical depth	G4 Aerosol Processes Reduce Uncertainty in key processes that link aerosols to weather, climate and air quality related impacts
C-5c Quantify the effect that aerosol has on cloud.	Weather, AQ, and Climate Modeling and Forecasting	Numerical Weather Prediction: Coupling of aerosols within NWP modeling	Assimilate aerosol observations into NWP models and simulate aerosol direct and indirect effects	NWP Centers (NOAA, NRL, ECMWF, JMA, NCAR), USDA, AFWA	Aerosol extinction profile, Cloud droplet concentration, Cloud phase profile, Precipitation particle size profile, Vertical air velocity profile	Cloud Mask, Radar reflectivity, Lidar Backscatter, Radar Doppler Shift	Vertical air velocity profile, Aerosol type		G2 Storm Dynamics: Improve our physical understanding and model representations of cloud, precipitation and dynamical processes within storms
W-4a Measure the vertical motion within deep convection to within 1 m/s and heavy precipitation rates to within 1 mm/hour to improve model representation of extreme precipitation and to determine convective transport and redistribution of mass, moisture, momentum, and chemical species.	Weather, AQ, and Climate Modeling and Forecasting	Numerical Weather Prediction: Development & Verification of Cloud/Convective Parametrizations	Use cloud properties, precipitation, vertical motion, and observables to validate and refine cloud parameterizations within NWP models to improve weather forecasts	NWP Centers (NOAA, NRL, ECMWF, JMA, NCAR), USDA, AFWA	Precipitation phase profile, Precipitation particle size profile, Cloud phase profile, Cloud droplet concentration	Radar Reflectivity, Radar Doppler shift, VIS reflectance, Thermal IR brightness temperature, microwave brightness temperature	vertical motion	Cloud properties, precipitation	G2 Storm Dynamics: Improve our physical understanding and model representations of cloud, precipitation and dynamical processes within storms
W-1a Determine the effects of key boundary layer processes on weather, hydrological, and air quality forecasts at minutes to subseasonal time scales.	Weather, AQ, and Climate Modeling and Forecasting	Numerical Weather Prediction: Representation of initial conditions and data assimilation	Assimilate satellite observations to improve representation of model initial state	NOAA, ECMWF, JMA, MeteoFrance, KNMI, BOM, UKMET, NASA, NCAR	Cloud top temperature, cloud optical depth, cloud phase profile, precipitation phase profile, vertical air velocity profile	Microwave Radiances, IR Radiances, Attenuated backscatter and depolarization ratio profiles, radar reflectivity	vertical motion	Cloud properties, precipitation	G2 Storm Dynamics: Improve our physical understanding and model representations of cloud, precipitation and dynamical processes within storms
W-1a Determine the effects of key boundary layer processes on weather, hydrological, and air quality forecasts at minutes to subseasonal time scales.	Weather, AQ, and Climate Modeling and Forecasting	Operational Air Quality Forecasting: Tracking dust, wildfire smoke, and volcanic plumes	Use aerosol observations from polar-orbiting and geostationary satellites along with AQ forecasts to track dust, wildfire smoke, and volcanic plumes	Federal (NOAA) and state AQ agencies, EPA, public and private companies	Aerosol Layer Heights, Aerosol Non-spherical Fraction	Cloud and Aerosol Masks, Aerosol Layer Types	Aerosol non-spherical fraction, Vertical aerosol distribution, aerosol speciated products from joint lidar and multispectral multiangular polarimeter retrievals	Aerosol Optical Depths CALIPSO-like Aerosol Types	G4 Aerosol Processes Reduce Uncertainty in key processes that link aerosols to weather, climate and air quality related impacts
H-1b Quantify rates of precipitation and its phase (rain and snow/ice) worldwide at convective and orographic scales suitable to capture flash floods and beyond.	Weather, AQ, and Climate Modeling and Forecasting	Weather Forecasting: Atmospheric Rivers	Use satellite observations of cloud and precipitation characteristics to assess and forecast impacts of atmospheric rivers	NASA, NOAA, NCAR, FEMA, National Hydromet. Agencies	Precipitation rate near surface, Convective core size, Cloud top temperature, Vertical air velocity profile	Doppler Radar reflectivity, Microwave brightness temperature, Thermal IR brightness temperature	vertical motion	precipitation	G2 Storm Dynamics: Improve our physical understanding and model representations of cloud, precipitation and dynamical processes within storms
W-1a Determine the effects of key boundary layer processes on weather, hydrological, and air quality forecasts at minutes to subseasonal time scales.	Weather, AQ, and Climate Modeling and Forecasting	Weather Forecasting: Aviation hazards related low clouds and fog, smoke, dust or icing	apply cloud, precipitation, and aerosol products to monitor synoptic scale systems to anticipate and monitor aviation hazards such as decreased ceilings and degraded visibility	NOAA, FAA, NCAR, Airlines, Private Sector Aviation Forecasting Companies	Cloud base height, cloud top height, cloud top temperature, cloud phase profile, cloud optical depth, Aerosol Extinction Profiles, Aerosol Speciation	radar reflectivity, doppler motion, vis reflectance, IR brightness temperature, Extinction profiles, multiangle radiance and polarization parameters	doppler and vertical motion	cloud properties, precipitation, VIS reflectances, IR brightness temperatures	G1 Cloud Feedback: Reduce the uncertainty in low- and high-cloud climate feedbacks by advancing out ability to predict the properties of low and high clouds
W-4a Measure the vertical motion within deep convection to within 1 m/s and heavy precipitation rates to within 1 mm/hour to improve model representation of extreme precipitation and to determine convective transport and redistribution of mass, moisture, momentum, and chemical species.	Weather, AQ, and Climate Modeling and Forecasting	Weather Forecasting: Monitoring and nowcasting of convective storms and hazards	Use satellite observations of convective cloud characteristics to identify and nowcast the development of storm hazards	NOAA, NWS, EUMETSAT, Commercial aviation	Precipitation discrimination, Cloud top temperature, Precipitation rate profile, Vertical air velocity profile, Precipitation phase profile	Radar Reflectivity, Radar Doppler shift, Thermal IR brightness temperature, Microwave brightness temperature, Attenuated backscatter and depolarization ratio profiles		Cloud properties, precipitation	G2 Storm Dynamics: Improve our physical understanding and model representations of cloud, precipitation and dynamical processes within storms
W-2a Improve the observed and modeled representation of natural, low-frequency modes of weather/climate variability.	Weather, AQ, and Climate Modeling and Forecasting	Weather Forecasting: Pre-fire weather monitoring for wildfire response and management.	Consider anomalies in near-term surface precipitation accumulation to asses drought severity or potential	NOAA, USFS, USGS, USAF, National Guard	Precipitation rate near surface, cloud base height	VIS reflectance, IR brightness temperatures		precipitation	G1 Cloud Feedback: Reduce the uncertainty in low- and high-cloud climate feedbacks by advancing out ability to predict the properties of low and high clouds
W-4a Measure the vertical motion within deep convection to within 1 m/s and heavy precipitation rates to within 1 mm/hour to improve model representation of extreme precipitation and to determine convective transport and redistribution of mass, moisture, momentum, and chemical species.	Weather, AQ, and Climate Modeling and Forecasting	Weather Forecasting: Tropical cyclone development and forecasting	Use satellite observations of cloud, precipitation, microphysical and aerosol characteristics to assess potential for tropical cyclone development, assess its intensity and forecast changes to intensity and track	NWS, NOAA, ECMWF, Meteo-France, NRL, HRD, DoD	Vertical air velocity profile, Precipitation rate profile, Cloud top temperature, Aerosol Optical Depth, Precipitation phase profile	Radar Reflectivity, Radar Doppler shift, Thermal IR brightness temperature, Microwave brightness temperature, UV/VIS reflectance, Attenuated backscatter and depolarization ratio profiles	vertical motion	Cloud properties, precipitation, Aerosol Optical Depth	G2 Storm Dynamics: Improve our physical understanding and model representations of cloud, precipitation and dynamical processes within storms