This ESS meeting focused on modeling, particularly Earth Systems modeling, as per the 2<sup>nd</sup> slide. Reports given by all key large scale modeling groups and centers.

Earth systems modeling based on global observations (atmosphere, oceans, land, ice) is a unique NASA capability, no other U.S science agency produces global satellite based datasets for this modeling.

The last 15 years ESD has deployed an unprecedented constellation of Earth observing satellites, and the data processing/archiving/distribution system to exploit the science

#### **Bretherton Diagram 198x**

CONCEPTUAL MODEL of Earth System process operating on timescales of decades to centuries Deep-Sea Solar Mapping Sediment System Landandice Continents & Topography Insolation (Milankovitch) Atmospheric Physics / Dynamics Climate Change Cloudiness Dynamics Radiation **Physical Impacts** Albedo1 Precip, Tair, Wind Stess\*. Evaporation', Sness, Tropospherio Albedo" SST Tair', Precip' Climate Extent<sup>®</sup> Insolation, n(CO<sub>2</sub>) Heat Flux, Albedo , Dust' Heat Flux\*, Heat Flux Forcing\* Leads" Net Fresh Water\* System  $n(O_3)$ Energy Holding Snow Mixed Layer Plant Transpiration/Photosynthesis Capacity Slopes Open Ocean Marginal Seas Terrestrial Surface Moisture / Energy Balance Ocean Dynamics Groundwater, RiverRunof SST\*, Moed Layer Depth\*, Upwelling\*, Circulation\* Soil Temperature Extremes\* ExcessWater φH<sub>2</sub>O)\* Cloudiness\* Development Soil Moisture\*, GPP\* Amount\*, Type\*, Stress\* n(Greenhouse Gases) Volcanism Maximum Marine Biogeochemistry Terrestrial Ecosystems Sustainable mpacts Stock Yield Production. Vegetation Human Particle Flux olar/Space UY\*, Decomposers Nutrient Plant/Stand Activities. Land Decomposition / Storage Particles\* Recycling Dynamics Uæ Plasmas Insoluble Marginal Seas Open Ocean φ(C,N,P) Soluble UY\*, φ(N<sub>2</sub>O) Biogeochemical ¢(CO2\_N2O,CH4,NH4) ¢(CH4) NO<sub>X</sub>)\* φco<sub>2</sub>),φs,NH<sub>4</sub>) n(CO<sub>2</sub>), pH (precip) n(CO<sub>2</sub>) Cycles ¢(CO₂) ¢(CFM₅) Human Tropospheric Chemistry Activities ¢(30,∞NO,) Cloud Processes Urban Boundary Layer Troposphere φN<sub>2</sub>O, ΦΟ) Polen (Vegetation) Foraminifera (Temperature) Deep-Sea ke Bog/Lake Sediment Cores Cores

<sup>&#</sup>x27;= on timescale of hours to days \* = on timescale of months to seasons  $\phi$  = flux n = concentration

 FINDING: New international agreement with the EU and ESA for full data sharing from new European satellites major step forward.

 FINDING: USGCRP Earth System Modeling "Summit" of Interagency teams in Feb 2015 positive first step in coordinating model development, global dataset production, validation activities. This coordinating activity should be continued.

 FINDING: NASA has an important role in <u>research</u> to improve weather forecasting because of the satellite observational network.

#### • FINDING:

The 2-step proposal review system has been used in ESD periodically for many years for certain competitions. The ESS finds that giving the program managers the option to use this review system when appropriate retains optimum flexibility.

#### 2 Other Topics

 NASA Big Data Task Force: ESD has two seats on committee, ESS will wait for a briefing.

- ESD Decadal Survey: Details at
- http://sites.nationalacademies.org/DEPS/esas 2017/index.htm

#### NASA Earth Science Division Modeling Interactions



Climate Variability and Change

Ca an

Carbon Cycle and Ecosystems

**Process and External Modeling** 

Earth Surface and Interior

NASA Earth System Modeling Atmospheric Composition

Weather

Scientific and Policy-Relevant Understanding Providing Societal Benefits Water & Energy Cycle