# *Project Science Office Update*

- **Biennial Review**
- **Data Products**
  - **MODIS variances with Data Product Handbook**
  - **Spatial resolution**
- **Miscellaneous**
  - **NRA response**
  - **EOS Science Implementation Plan**

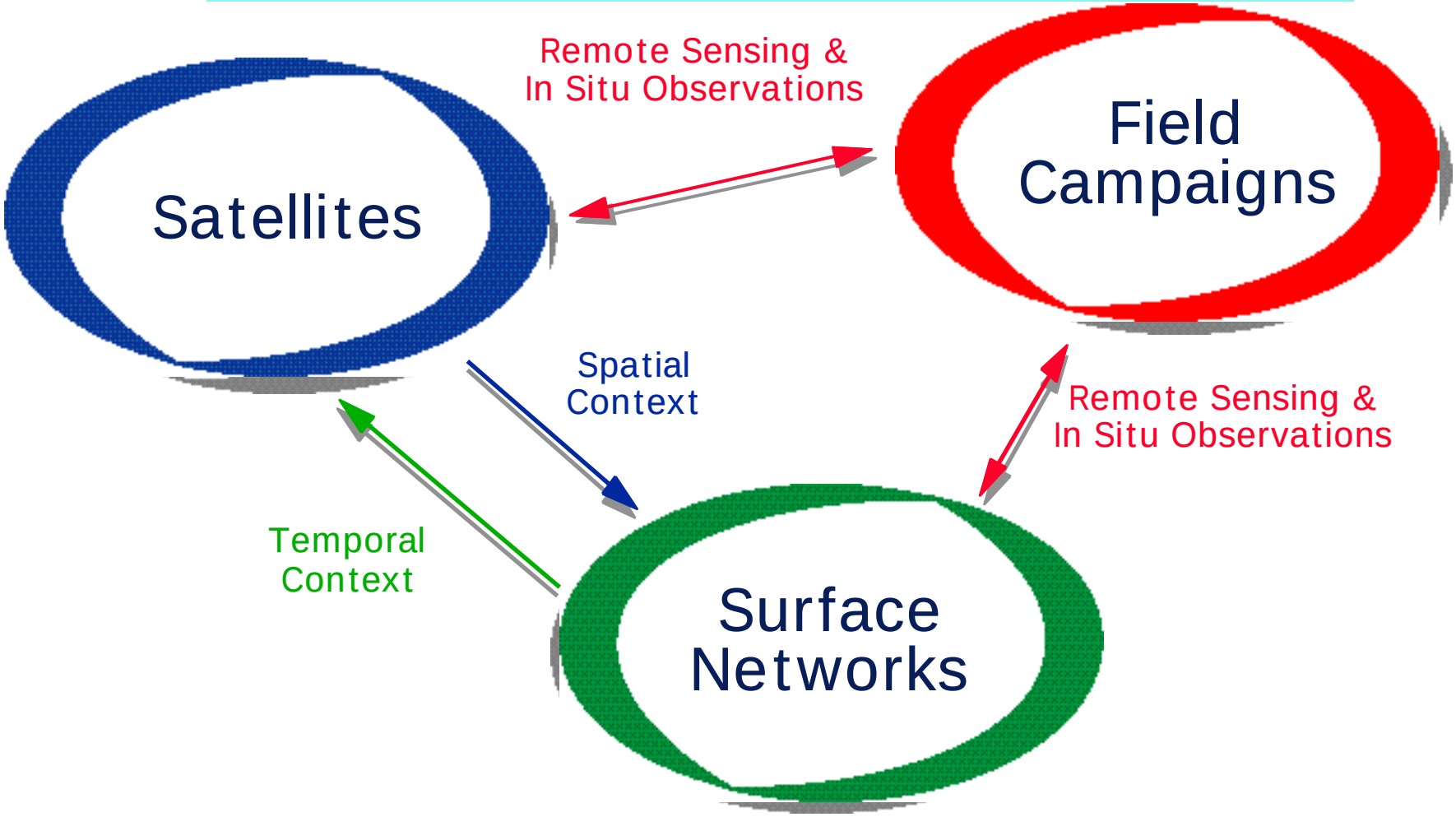
# *Biennial Review*

- **Purpose**
  - **Assess whether MTPE approach to planning and implementing programs to address its science themes are sound**
    - » **Does MTPE have effective processes for incorporating new scientific and technology advances?**
    - » **How well is MTPE positioning itself to engage in fruitful partnerships with commercial, interagency and international partners?**
  - **Are the recommendations of the Atmospheric Chemistry and EOSDIS review panels sound and implementable**
    - » **Fly EOS-Chemistry on common spacecraft**
    - » **Is EOSDIS architecture and customer base the right one?**
  - **Articulate and justify restoring the R&A funding to 1994 levels**
  - **Is the MTPE strategy for defining and implementing post-Chem 1 missions sound (just in time procurements, international, interagency, technology, etc.)**

# *Research and Observations Strategy*

- **MTPE research priorities require a balance of:**
  - ***Global Satellite Observations*** **– including the NASA/NOAA Pathfinder and other ongoing data analysis projects, the Earth Observing System (EOS) program, Earth System Science Pathfinders (ESSP) small research satellite missions, and multi-agency planning for the National Polar-orbiting Operational Environmental Satellite System (NPOESS)**
  - ***Process Studies and Field Campaigns*** **– ground-based and airborne in situ and remote sensing measurements planned and implemented by the basic MTPE Science Discipline Programs under the Research and Analysis (R&A) Program**
  - ***Modeling Studies*** **– including data assimilation, climate diagnostics, model improvements through organized community intercomparisons, observing system simulation experiments, and prediction/assessment runs**

# *Interagency Validation Strategy*



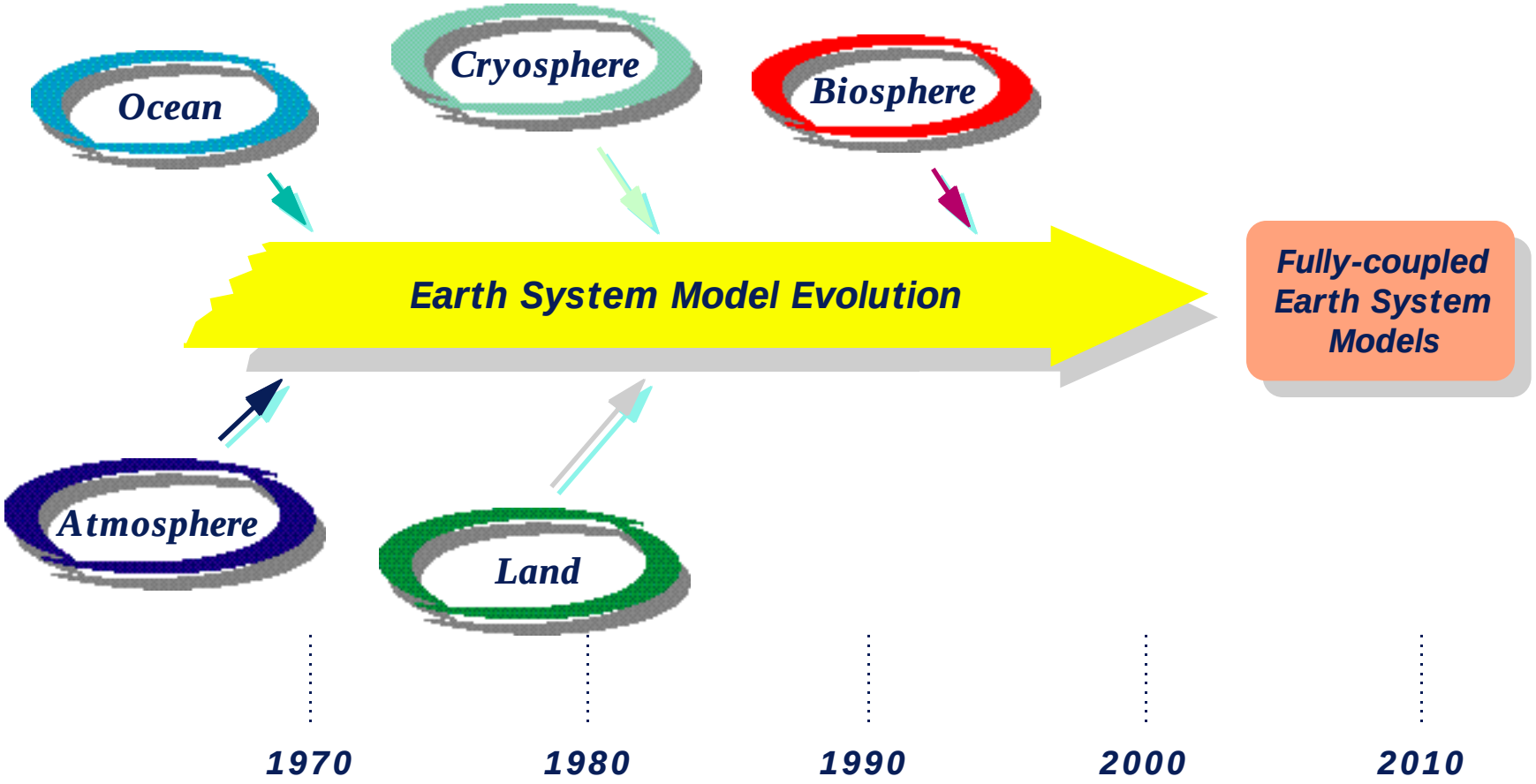
# *Interagency Validation Strategy*

- **Global Satellite Observations**
  - Earth Observing System (EOS), Earth System Science Pathfinders (ESSP), Earth Probes, New Millennium Program (NMP), international and interagency spacecraft
- **Process Studies and Field Campaigns**
  - International and interagency focused field campaigns (e.g., FIRE, ASTEX, ASHOE, TOTE/VOTE, TRACE-A, SCAR, SASS, SHEBA, BOREAS, LBA)
  - In situ and remote sensing observations, vertical profiles, validation of spaceborne observations (e.g., JGOFS, AMT, M-AERI)
- **Ground-based Observations**
  - *Department of Energy* – Atmospheric Radiation Measurement (ARM) program at Southern Great Plains (SGP), Tropical Western Pacific (TWP) and North Slope Alaska (NSA)
  - *National Science Foundation* – Long-Term Ecological Research (LTER) sites, Antarctica (South Pole & McMurdo), JGOFS ships (R/V Nathanial B. Palmer)
  - *Department of Commerce* – NOAA CMDL network, meteorological networks, TOGA-TAO array, NIST calibration (round-robins, transfer radiometers, etc.)
  - Cimel sun/sky radiometers (AERONET), Marine Optical Buoy (MOBY), and SIMBIOS

# *Airborne Science Program*

- **NASA Aircraft**
  - Master schedules have been developed for NASA ER-2s, DC-8, and P-3B
    - » Research & Analysis (R&A) program for FY97-00
    - » EOS Validation plans for FY97-01 (AM-1, SAGE III, AMSR-E)
- **Interagency aircraft planning**
  - Department of Energy (DoE) Citation
  - National Center for Atmospheric Research (NCAR) C-130Q
- **University aircraft facilities**
  - University of Washington CV-580
    - » in situ cloud microphysics, tropospheric chemistry, aerosol properties, atmospheric lidar, and radiation
  - University of North Dakota Citation
    - » in situ cloud microphysics, especially upper tropospheric ice clouds
- **Airborne Sensors**
  - Airborne sensors supported by MTPE for the benefit of validation activities (e.g., MAS, MASTER, AirMISR, MATR, AVIRIS)
  - Calibration and characterization facilities at Ames and Goddard

# Earth System Model Development



# *Earth System Model Development*

- **Goal**
  - Improve prediction of weather, climate (i.e., floods, droughts, etc.), and biological productivity on local and global scales, and from days to centuries
- **General**
  - Earth observations from space are used to develop models of various Earth system processes; these models are later coupled to produce Earth system models
  - Increased computer power is allowing many improvements in global change models (GCMs), including improved resolutions, faster run times, satellite date assimilation, and more complete treatment of coupling amongst atmosphere, ocean, land, biosphere, and cryosphere components
  - In the 1980s continuous global data sets from satellites became available for model development, model validation, and initialization
- **Resolution**
  - Horizontal and vertical resolutions have increased in many GCMs, some atmospheric GCMs now have horizontal resolutions of 2.5° and some ocean GCMs now being tested with stretched or rotated grid schemes have resolutions in the equatorial oceans as fine as ~0.5° in latitude

# *Earth System Model Development*

- **Atmosphere**
  - Improvements being made in GCM cloud formulations should lead to improved understanding of the role of clouds and precipitation in global climate change
- **Ocean**
  - Global eddy-resolving ocean GCMs have been created and are reproducing features observed from satellite data sets, with salinity and momentum transport being important new considerations
- **Land**
  - Simple bucket soil moisture formulations are being replaced by more complex land surface process schemes, and up-scaling of physical hydrology models to basin scales
- **Biosphere**
  - GCMs are being enhanced by the incorporation of biosphere models with increasingly realistic treatments of water, energy, and carbon exchanges
- **Cryosphere**
  - Sea ice is being incorporated in several GCMs, with increased sophistication in both ice thermodynamics (through increasing the number of layers in the ice and overlying snow) and ice dynamics

# *Earth System Model Development*

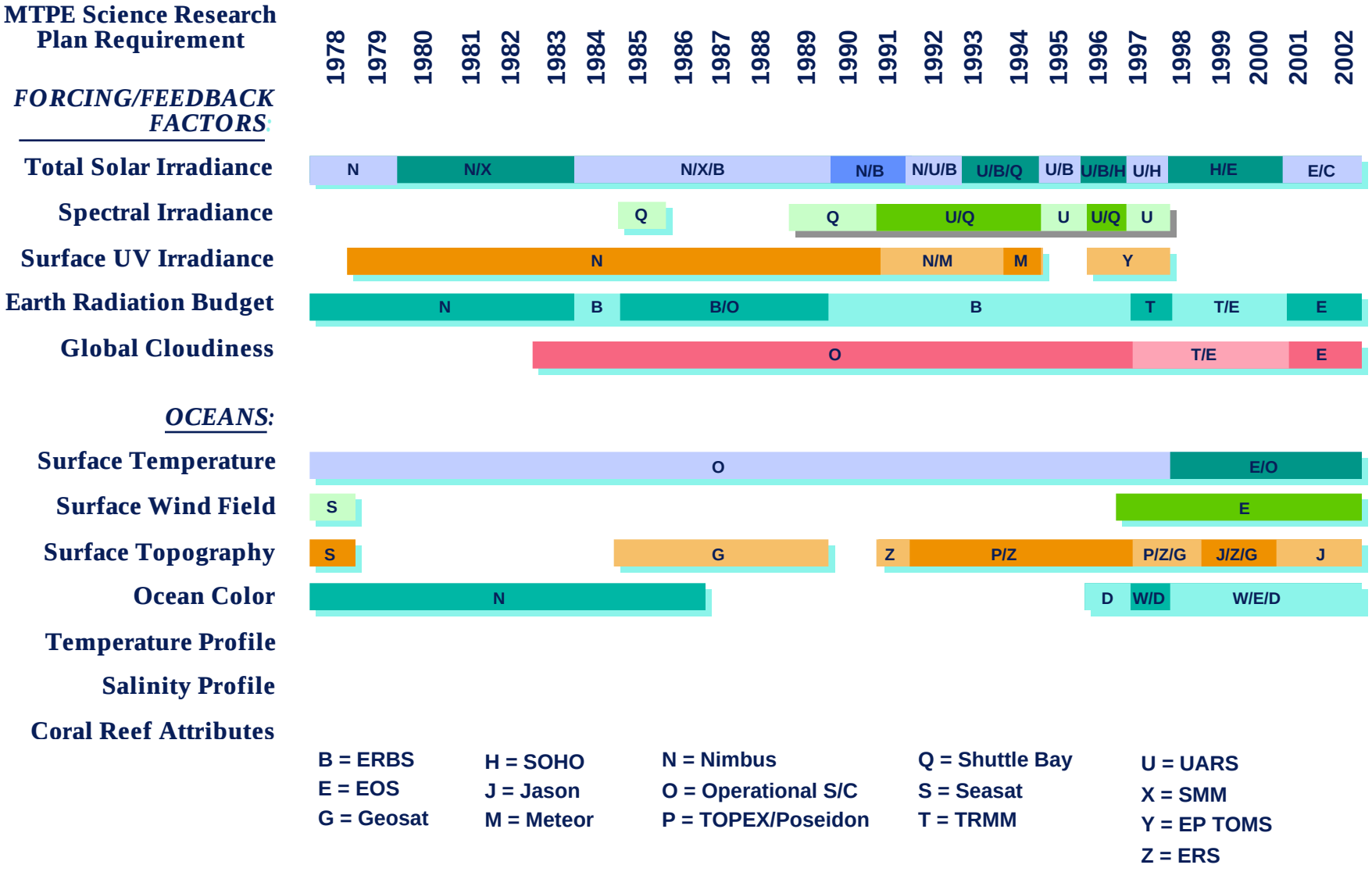
- **Remote sensing and Earth system models**
  - **Model development depends on continuous (time and space) global observations of the state of the Earth system for parameterization, initialization, and validation**
  - **Remote sensing has the greatest potential for providing such data as sea surface temperature, snow cover, vegetation, Earth radiation budget, cloud cover and properties, precipitation, humidity, land surface temperature, ocean circulation, surface winds over the ocean, etc.**
- **Assessments**
  - **Major assessment activities comparing results from over 20 GCMs are helping identify strengths and weaknesses in various models**

# Measurements to Meet MTPE Scientific Priorities

| MTPE Science Research Plan Requirement | Seasonal-to-Interannual Climate Variability | Long-Term Climate Variability and Change | Atmospheric Ozone | Land Cover and Land Use Change | Natural Hazards |
|---|---|---|---|---|---|
| ***FORCING/FEEDBACK FACTORS:*** | | | | | |
| Total Solar Irradiance | ✓ | ✗ | ⊘ | ⊘ | ⊘ |
| Spectral Irradiance | ✓ | ✓ | ✗ | ⊘ | ⊘ |
| Surface UV Irradiance | ✓ | ✓ | ✗ | ✓ | ✓ |
| Earth Radiation Budget | ✗ | ✗ | ⊘ | ✓ | ⊘ |
| Global Cloudiness | ✗ | ✗ | ✓ | ✓ | ✓ |
| ***OCEANS:*** | | | | | |
| Surface Temperature | ✗ | ✗ | ⊘ | ✓ | ✓ |
| Surface Wind Field | ✗ | ✓ | ⊘ | ⊘ | ✗ |
| Surface Topography | ✗ | ✗ | ⊘ | ⊘ | ⊘ |
| Ocean Color | ✗ | ✗ | ⊘ | ✗ | ⊘ |
| Temperature Profile | ✗ | ✗ | ⊘ | ⊘ | ⊘ |
| Salinity Profile | ✓ | ✗ | ⊘ | ⊘ | ⊘ |
| Coral Reef Attributes | ⊘ | ✗ | ⊘ | ⊘ | ⊘ |

✗ *Primary* ✓ *Secondary* ⊘ *Not Applicable*

# Global Earth Observation Data Record



# EOS Total Data Products

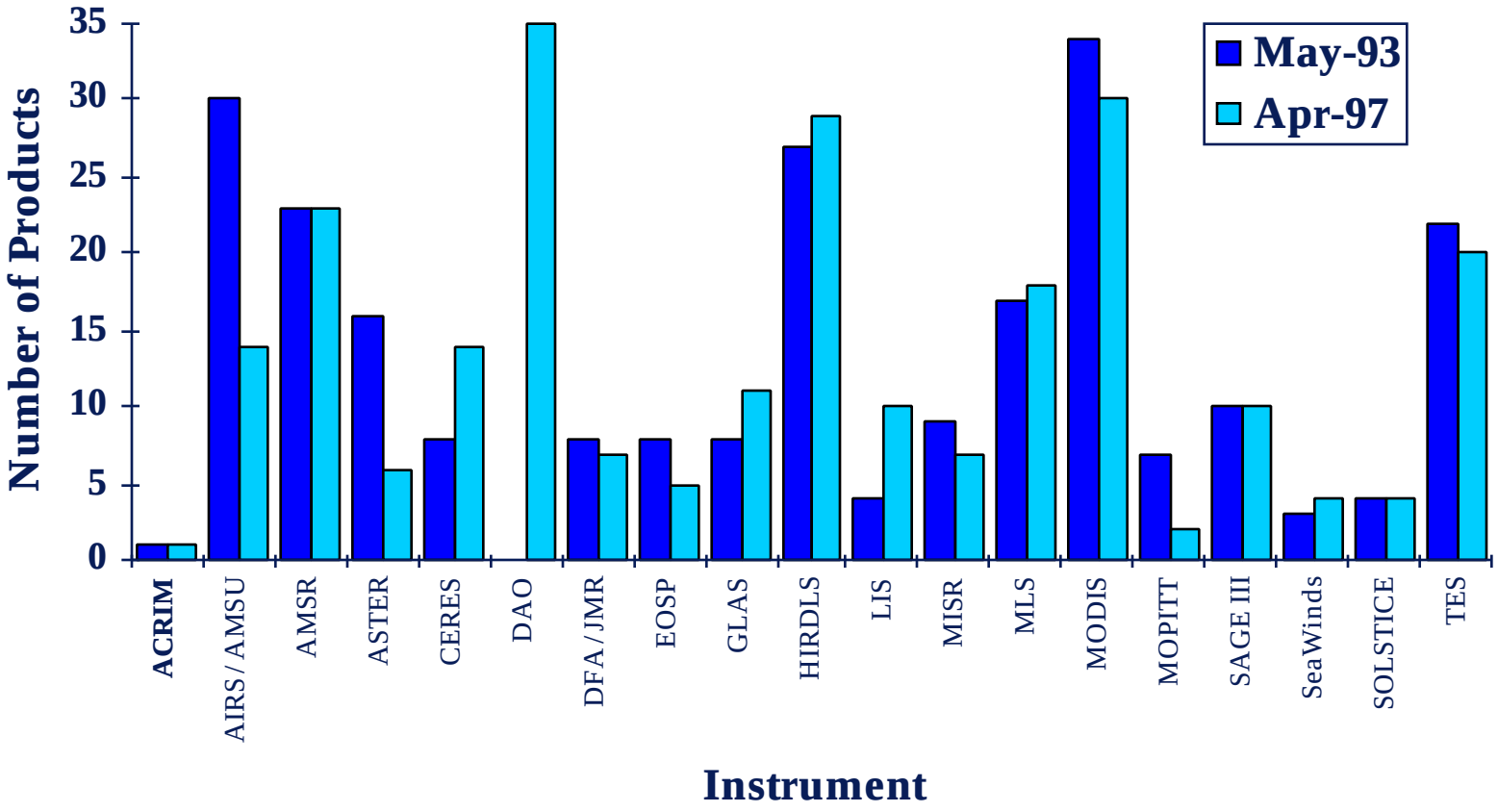
| May 1993 | At-launch | Post-launch | Total |
|---|---|---|---|
| Standard | | | |
| Routine | 145 | 59 | 204 |
| On-request | 12 | 9 | 21 |
| Software | 5 | 9 | 14 |
| | | | 239 |
| **April 1997** | | | |
| Standard | | | |
| Routine | 168 | 68 | 236 |
| On-request | 3 | 2 | 5 |
| Software | 1 | 8 | 9 |
| Validation | 2 | 0 | 2 |
| Research | 6 | 15 | 21 |
| Internal | 8 | 1 | 9 |
| | | | 282 |

# EOS Standard Data Products by Level

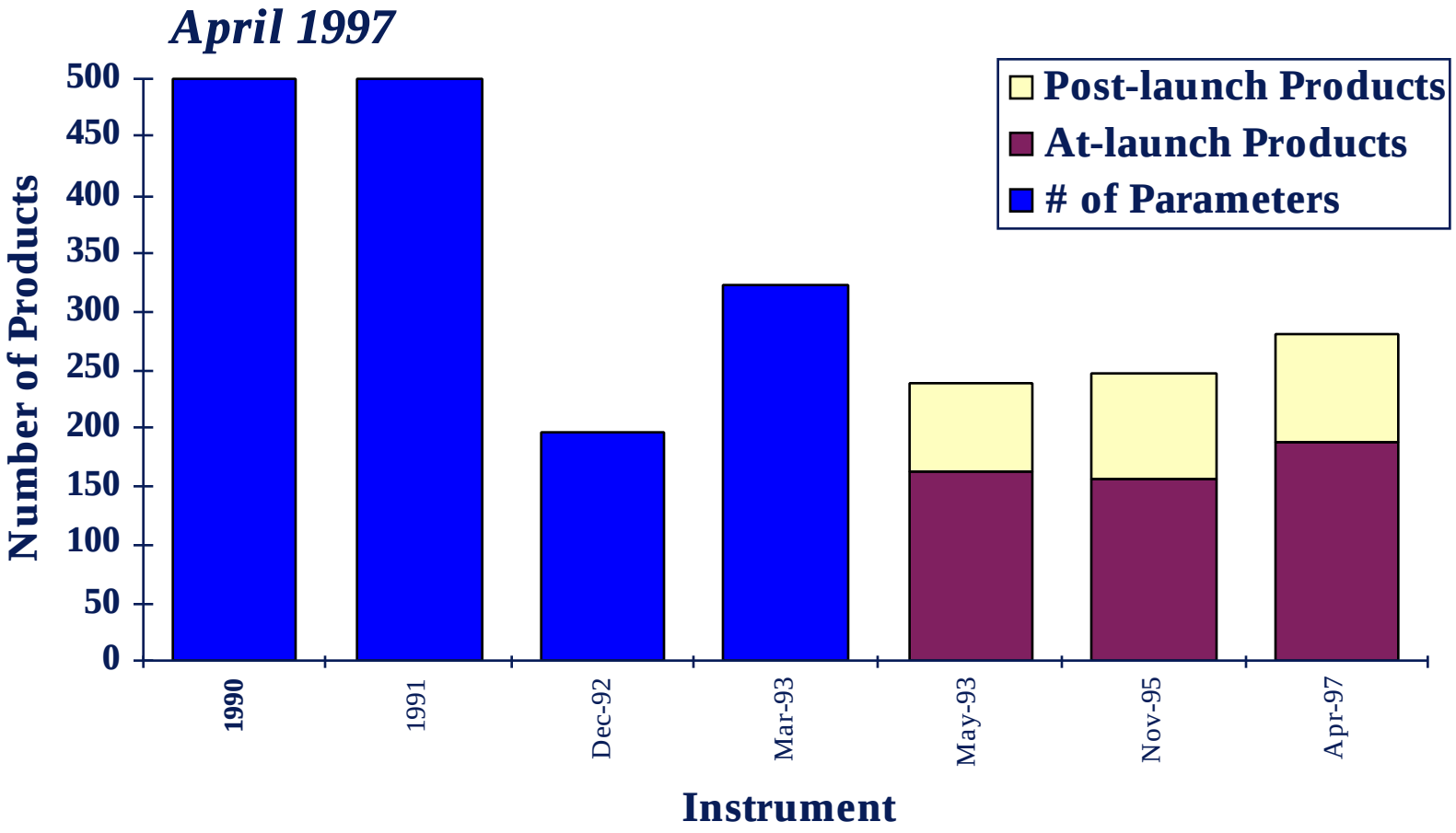
***April 1997***

| | *At-launch* | *Post-launch* | *Total* |
|---|---|---|---|
| *Level 1A* | 10 | 0 | 10 |
| *Level 1B* | 27 | 2 | 29 |
| *Level 2* | 93 | 11 | 104 |
| *Level 3* | 7 | 62 | 69 |
| *Level 4* | 35 | 3 | 38 |
| *Total* | 172 | 78 | 250 |

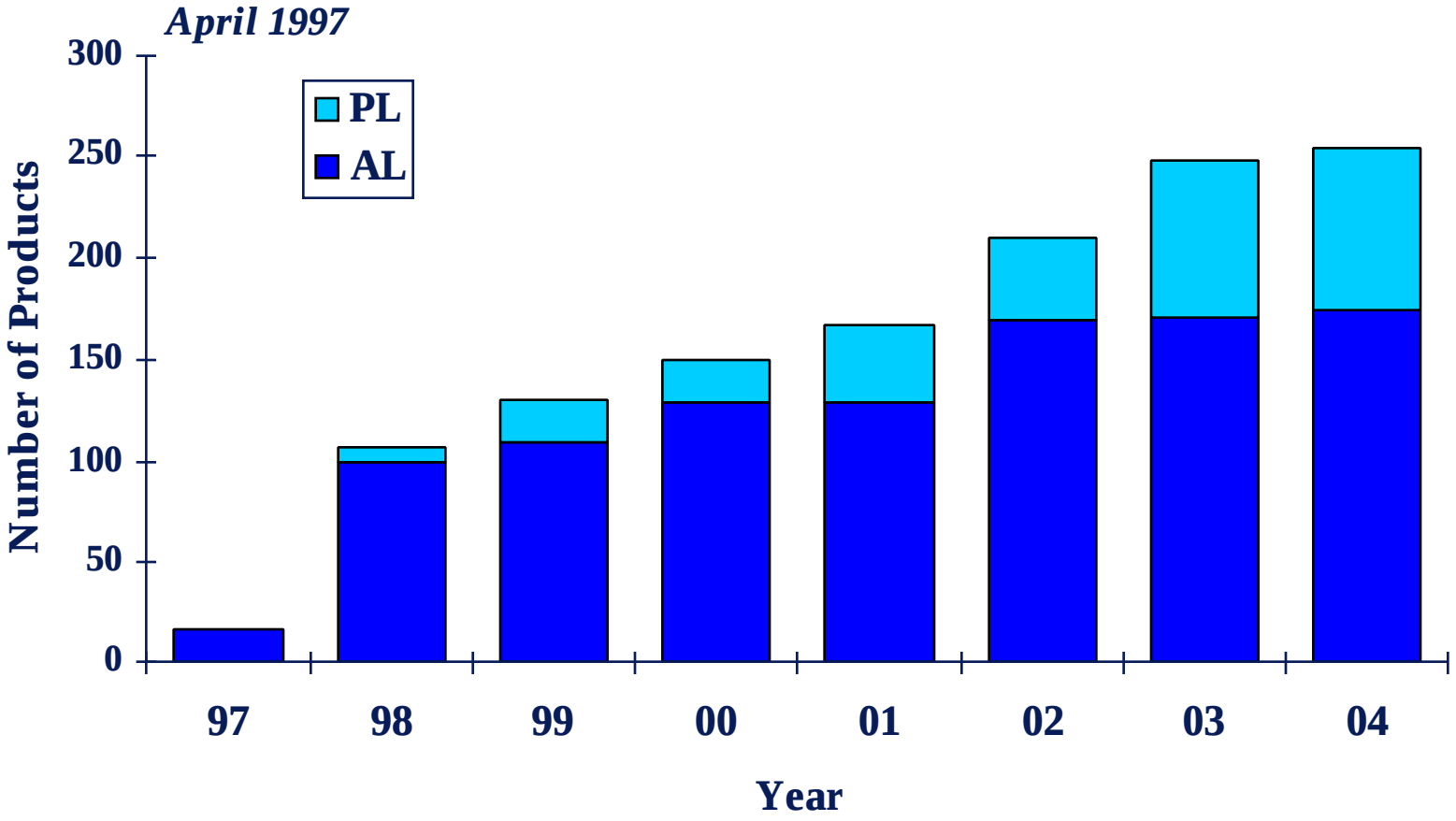
# EOS Standard Data Products (AL & PL)



# EOS Total Data Products (AL & PL)



# Standard Products (AL & PL)



# ATBD Statistics

| | ATBDs | Validation Plans |
|---|---|---|
| ACRIM | 1 | 0 |
| AIRS | 3 | 0 |
| AMSR | 6 | 0 |
| ASTER | 8 | 1 |
| CERES | 10 | 1 |
| DAO | 1 | 0 |
| LIS | 1 | 1 |
| MISR | | |
| Land | 1 | 0 |
| All Others | 9 | 1 |
| MODIS | | |
| Level 1 | 2 | 1 |
| Atmosphere | 6 | 1 |
| Land | 9 | 1 |
| Ocean | 11 | 1 |
| MOPITT | 2 | 1 |
| SAGE III | 9 | 1 |
| SeaWinds | 1 | 0 |
| Total | 80 | 10 |

# *Standard Data Products Resources Board*

- **Purpose**
  - Establish a process to assess and manage change to the EOS data products list
  - Allocate data processing resources (MFLOPS) and storage space (GBytes) among science teams commensurate with available resources
- **Requirements**
  - Assess maturity of algorithm based primarily on ATBD review process
  - Evaluate impact of interdependencies when adding and deleting data products
  - Ensure that resource allocations are consistent with science priorities
  - Recommend “DAAC” assignment for routine data production
- **Membership**
  - Skip Reber, Chair
  - Yoram Kaufman
  - Bruce Barkstrom
  - Ghassem Asrar
  - H. Ramapriyan
  - David Glover

# Standard Data Products: Outstanding Issues

- **Accuracy of Data Products Database**
  - **Hughes ECS building to February 1996 baseline**
  - **1997 Data Products Handbook differs in substantive ways**

| | *February 1996 EOSDIS Baseline* | *1997 Data Product Handbook* | *Discrepancies* |
|---|---|---|---|
| *ASTER* | 12 | 10 | 1 IN & 1 SP not shown |
| *CERES* | 15 | 13 | 1 IN & 1 SP not shown |
| *DAS* | 4 | 35 | major changes |
| *LIS* | 10 | 18 | 8 new products added |
| *MISR* | 8 | 9 | 1 new product added |
| *MODIS* | 42 | 41 | 2 new products, 3 dropped, IN products reclassified as standard |
| *MOPITT* | 5 | 2 | level-3 products not shown |

**IN = interim, SP = special**

# *EOS Project Science Office*

- **NRA on correlative measurement program for EOS-wide validation received 340 letters of intent**
- **Six of ten Science Plan chapters received**
  - **Chapter 4: Radiation, Clouds, Water Vapor, and Precipitation (Hartmann)**
  - **Chapter 5: Oceanic Circulation, Productivity, and Exchange with the Atmosphere (Rothrock)**
  - **Chapter 6: Greenhouse Gases and Tropospheric Chemistry (Schimel)**
  - **Chapter 7: Land Ecosystems and Hydrology (Running, Sorooshian, Washburn)**
  - **Chapter 9: Ozone and Stratospheric Chemistry (Schoeberl)**
  - **Chapter 10: Volcanoes and Climate Effects of Aerosols (Hartmann & Mouginis-Mark)**