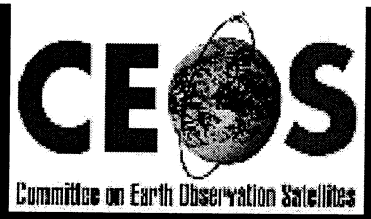


# CEOS Precipitation Constellation

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for
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Ottawa, Canada
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CEOS
Committee on Earth Observation Satellites

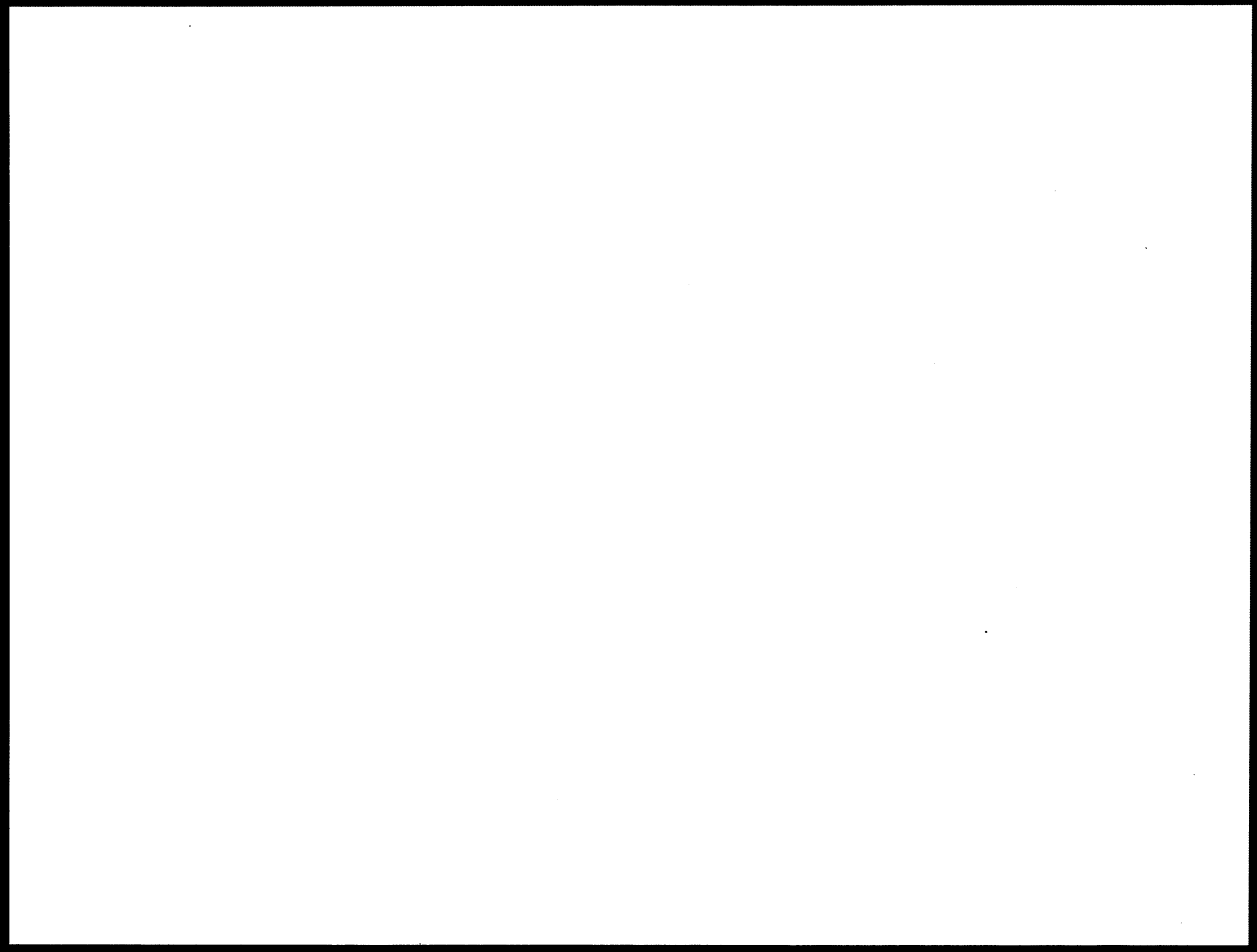
# μια Χελιδων εαρ ου ποιει

A single swallow does not make a spring

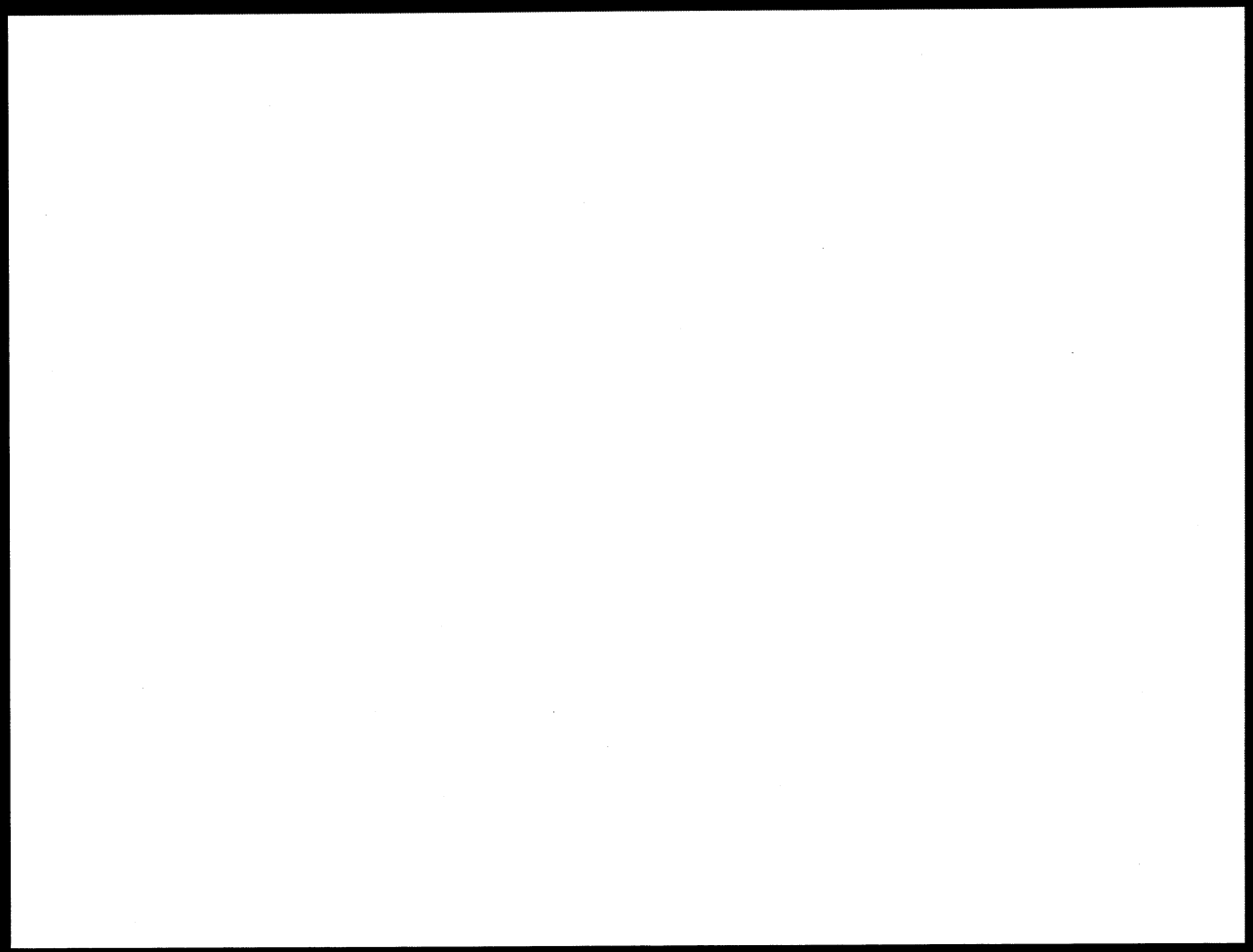
# Discussion Topics

- Why a constellation
- Who is working on it
- Where are we
- Where are we going
- What is the approach

# 3 HR TRMM Only Rainfall



# Merged 3 hr Rainfall



# Contributing Organizations

- NASA
- JAXA
- NOAA
- Naval Research Laboratory
- Canadian Space Agency
- European Space Agency
- WMO

# Participation

- **CEOS SIT Liaison:**
  - USA – NOAA: Mary Kicza, Mary.Kicza@noaa.gov
- **Study Lead agencies:**
  - Japan - JAXA (Riko Oki, oki.riko@jaxa.jp) & USA - NASA (Steven Neeck, steven.neeck@nasa.gov)
- **Space agency participants:**
  - France - CNES: Didier Renaut, didier.renaut@cnes.fr
  - India - ISRO: contacted
  - Brazil – INPE: Carlos Frederico Angelis, angelis@cptec.inpe.br
  - Europe - ESA: Einar-Arland Herland, einar-arland.herland@esa.int
  - China - CAST/NRSCC: contacted
  - USA - NOAA: Ralph Ferraro, ralph.r.ferraro@noaa.gov
  - USA – Naval Research Laboratory: Joe Turk, turk@nrlmry.navy.mil
  - Europe - EUMETSAT: Johannes Schmetz, Johannes.Schmetz@eumetsat.int
  - Canada - Canadian Space Agency: David Kendall, Dave.Kendall@space.gc.ca

# Participation (cont.)

- **User Community Representatives:**
  - CGMS-IPWG: Ralph Ferraro, ralph.r.ferraro@noaa.gov
  - GEWEX: Chris Kummerow, kummerow@atmos.colostate.edu
  - WCRP/IGWCO: Rick Lawford, lawford@umbc.edu
  - GCOS: Paul Mason, p.j.mason@reading.ac.uk
  - Peter Bauer, Peter.Bauer@ecmwf.int
  - Phil Arkin, parkin@essic.umd.edu

# Implementation

- The implementation of CEOS PC is in four phases

| year | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| phase | study phase | GPM preparatory phase | | | | | GPM phase | | | | | post -GPM phase | |
| | | | | | | | GPM | | | | | | |

# Existing Precipitation Constellation

- Multiple satellite/instruments have been used for long time by applications agencies and researchers
- The existing constellation includes
  - TRMM TMI as a calibrator in some applications
  - DMSP SSM/I series of instruments (currently F13, F14, and at times F15)
  - Aqua AMSRE
  - IR data to fill
- Added soon Metop and NOAA-N (next quarter)

# Uses of Current PC

- NASA currently routinely producing a near-realtime 3hr merged global rainfall product on .25 x .25 deg grid
  - Used in prototyping flooding and landslide applications
  - Used on regular basis converted into GIS format by disaster monitoring groups
  - Available free of charge via anonymous ftp
- NOAA and NRL also routinely produce a 3 hr merged rainfall product in near-realtime using different approaches
- JAXA has a prototype 3-hr merged rainfall product which is planned to be operational within 1 year
- NASA,NOAA and Japan Meteorological Agencies all assimilating either brightness temperatures or rainrates from the current PC

# PC Evolution

- Already in an evolutionary via the international Global Precipitation Measurement (GPM) activities led by NASA/JAXA
- GPM from the outset planned as a constellation based on partnerships among U.S. agencies and international partners
- GPM improves on current PC by providing a community based reference standard to intercalibrate precipitation radiometers at the brightness temperature phase
- Current efforts through GPM include an international science working group to develop the most effective intercalibration approach

# PC Evolution (2)

- GPM implementation of the PC will
  - increase temporal coverage by radiometers
  - and improve quality of data through inter-calibration
- GPM implementation will provide ground validation by applying focus validation at a number of GPM international partner ground sites
- GPM NASA/JAXA partners working to obtain other space and ground assets from potential international partnerships

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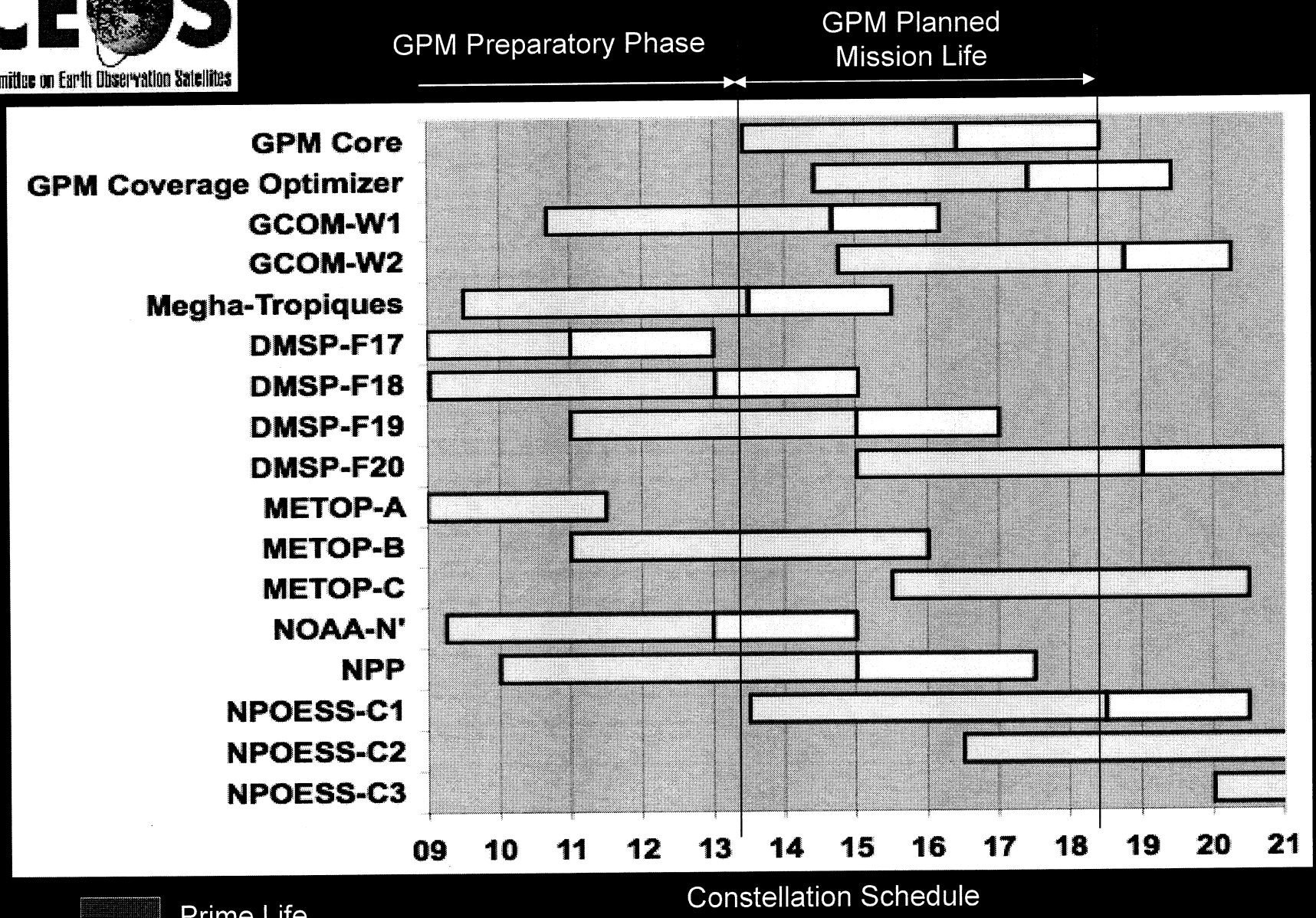


*(based on currently available estimates)*

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# Passive Microwave Sensor (PMW) Characteristics in the GPM Era

## Constellation microwave sensor channel coverage

**V – Vertical Polarization** **H – Horizontal Polarization**

| Channel | 6 GHz | 10 GHz | 19 GHz | 23 GHz | 31/36 GHz | 50-60 GHz | 89/91 GHz | 150/166 GHz | 183/190 GHz |
|---|---|---|---|---|---|---|---|---|---|
| AMSR-E | 6.925 V/H | 10.65 V/H | 18.7 V/H | 23.8 V/H | 36.5 V/H | | 89.0 V/H | | |
| GMI | | 10.65 V/H | 18.70 V/H | 23.80 V | 36.50 V/H | | 89.0 V/H | 165.5 V/H | 183.31 V |
| MADRAS | | | 18.7 V/H | 23.8 V | 36.5 V/H | | 89.0 V/H | 157 V/H | |
| SSMIS | | | 19.35 V/H | 22.235 V | 37.0 V/H | 50.3-63.28 V/H | 91.65 V/H | 150 H | 183.31H |
| MHS | | | | | | | 89 V | 157 V | 183.311 H<br>190.311 V |
| ATMS | | | | 23.8 | 31.4 | 50.3-57.29 | 87-91 | 164-167 | 183.31 |

## Mean Spatial Resolution (km)

| Channel | 6 GHz | 10 GHz | 19 GHz | 23 GHz | 31/36 GHz | 50-60 GHz | 89/91 GHz | 150/166 GHz | 183 GHz |
|---|---|---|---|---|---|---|---|---|---|
| AMSR-E | 56 | 38 | 21 | 24 | 12 | | 5 | | |
| GMI | | 26 | 15 | 12 | 11 | | 6 | 6 | 6 |
| MADRAS | | | 40 | 40 | 40 | | 10 | 6 | |
| SSMIS | | | 59 | 59 | 36 | 22 | 14 | 14 | 14 |
| MHS | | | | | | | 17 | 17 | 17 |
| ATMS | | | | 74 | 74 | 32 | 16 | 16 | 16 |

***Different center frequencies, viewing geometry, and spatial resolution must be reconciled***