Committee on the Peaceful Uses of Outer Space
Science and Technology Sub-committee
Forty-seventh session
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Vienna, Austria

International Cooperation in Operational Environmental Satellites: The U.S. Experience

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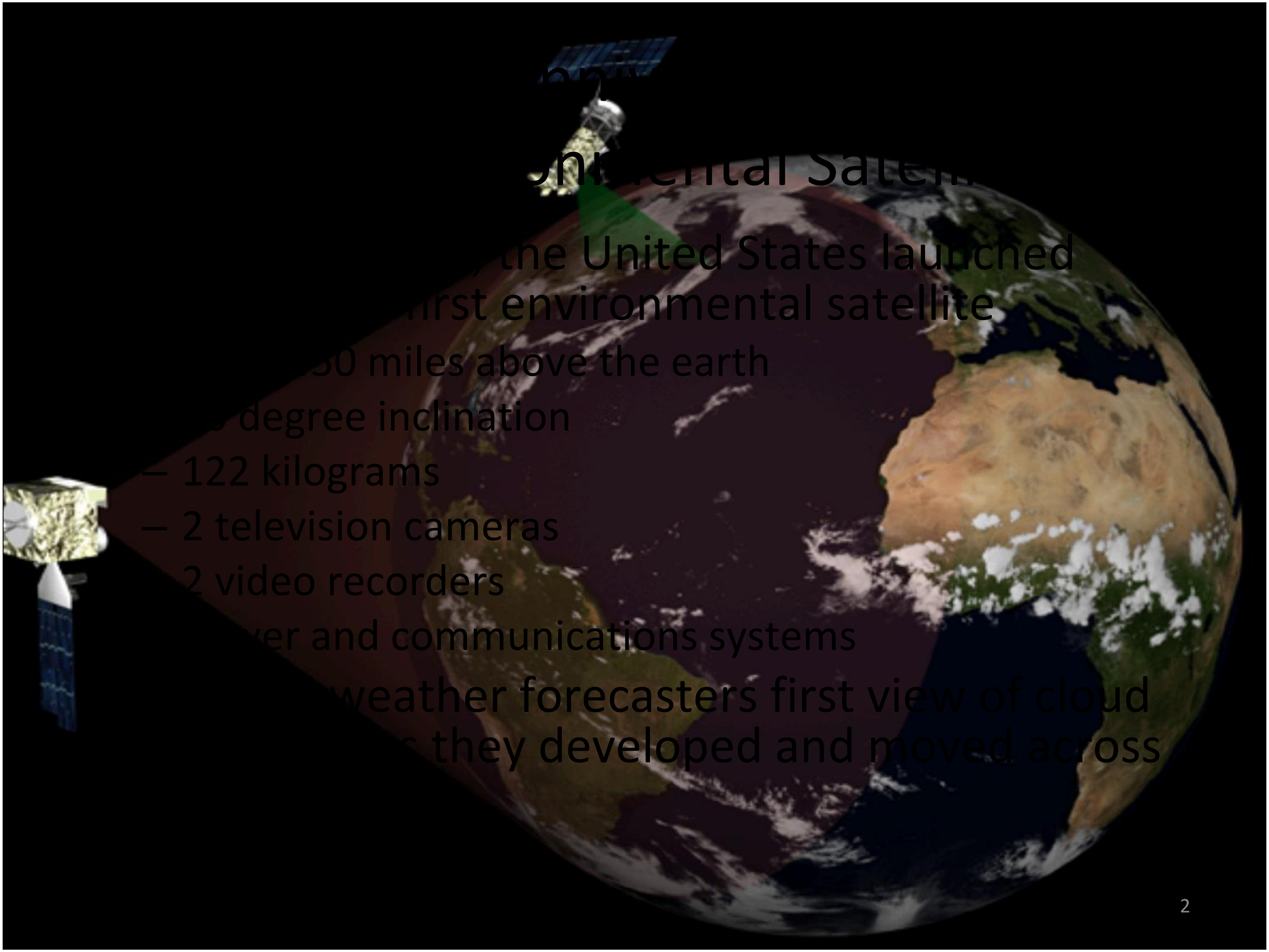
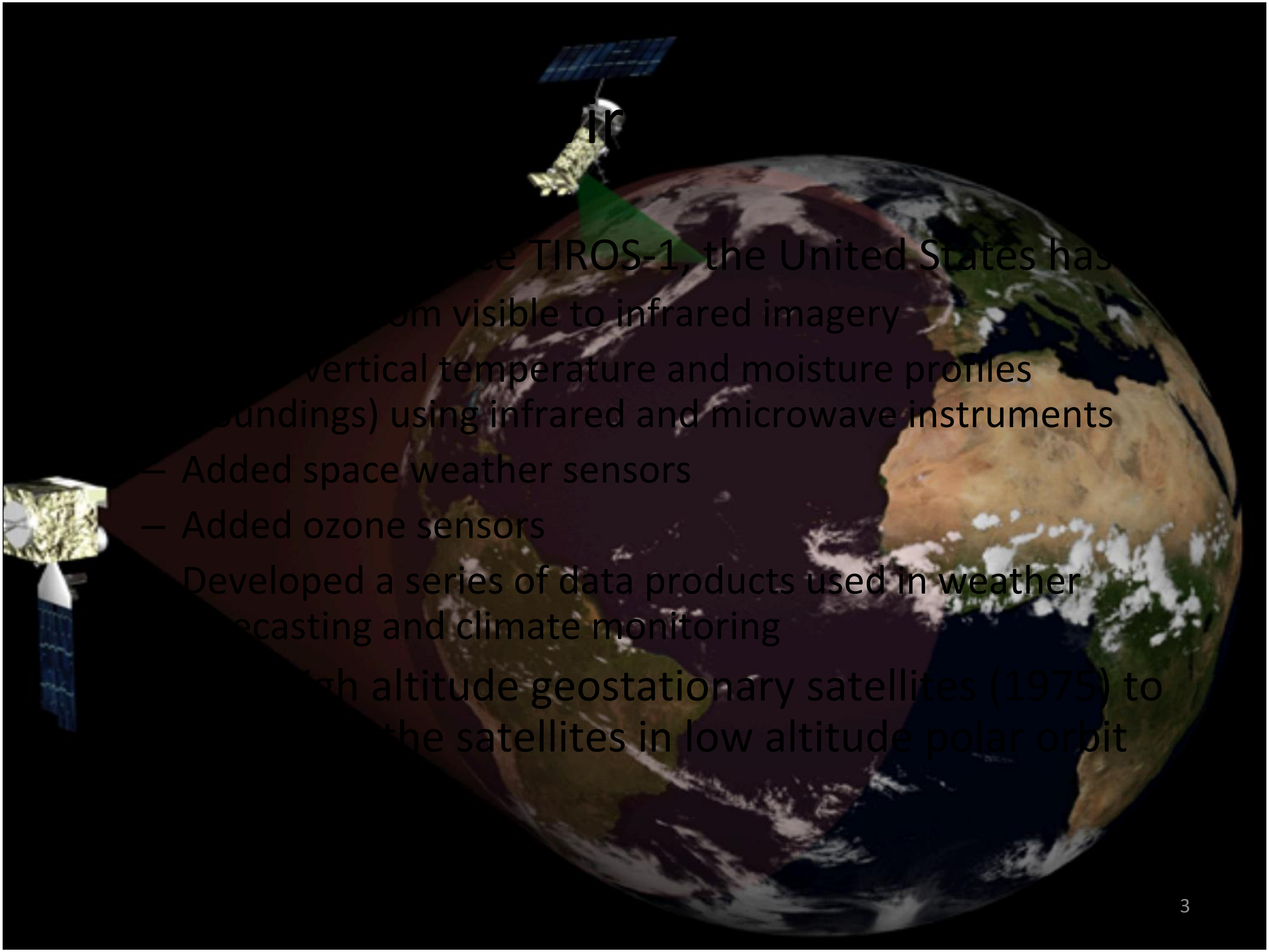

the United States launched
first environmental satellite
30 miles above the earth
degree inclination
– 122 kilograms
– 2 television cameras
2 video recorders
and communications systems
weather forecasters first view of cloud
they developed and moved across



ir

ce TIROS-1, the United States has

om visible to infrared imagery

vertical temperature and moisture profiles

oundings) using infrared and microwave instruments

– Added space weather sensors

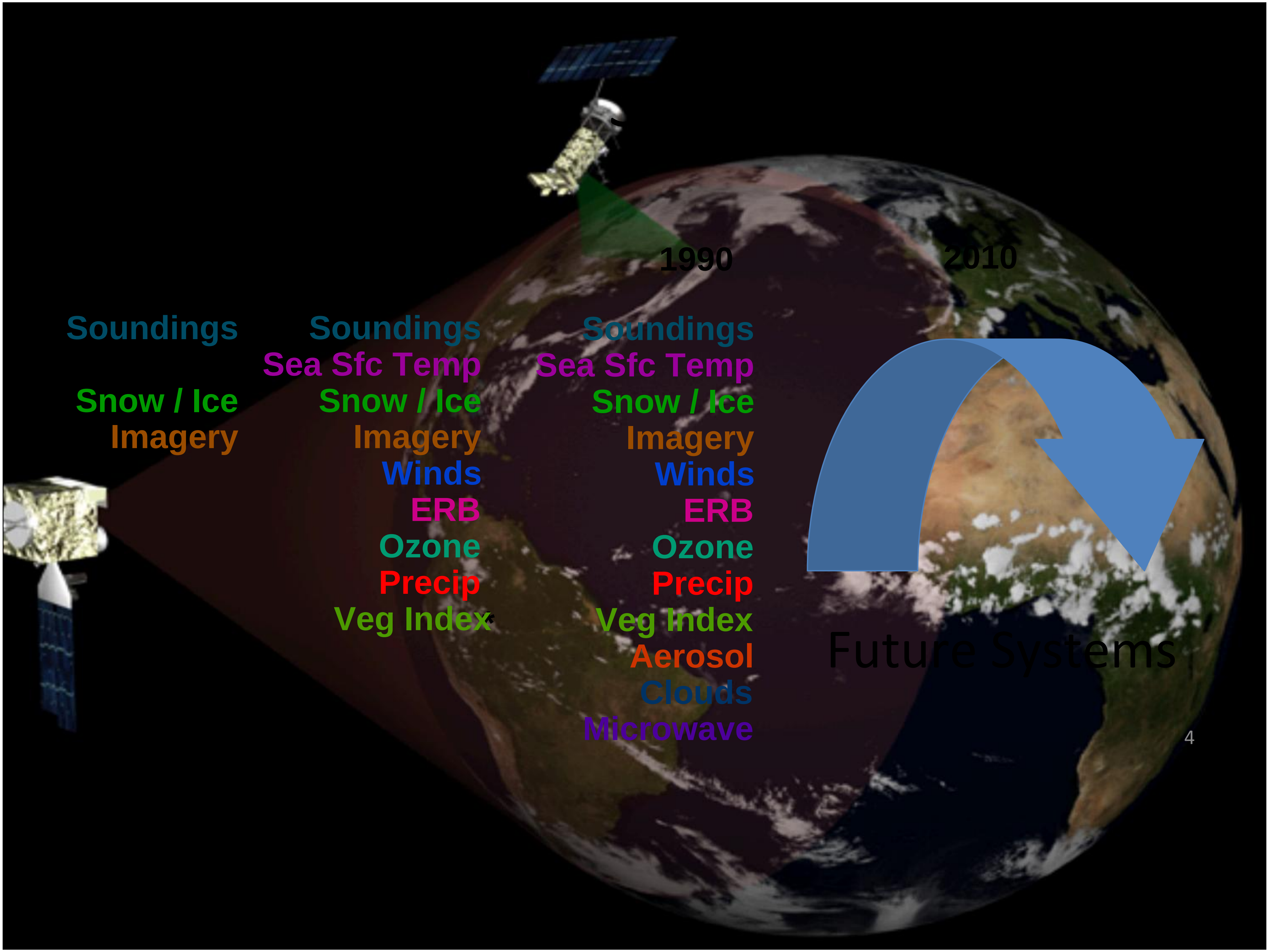
– Added ozone sensors

Developed a series of data products used in weather

ecasting and climate monitoring

h altitude geostationary satellites (1975) to

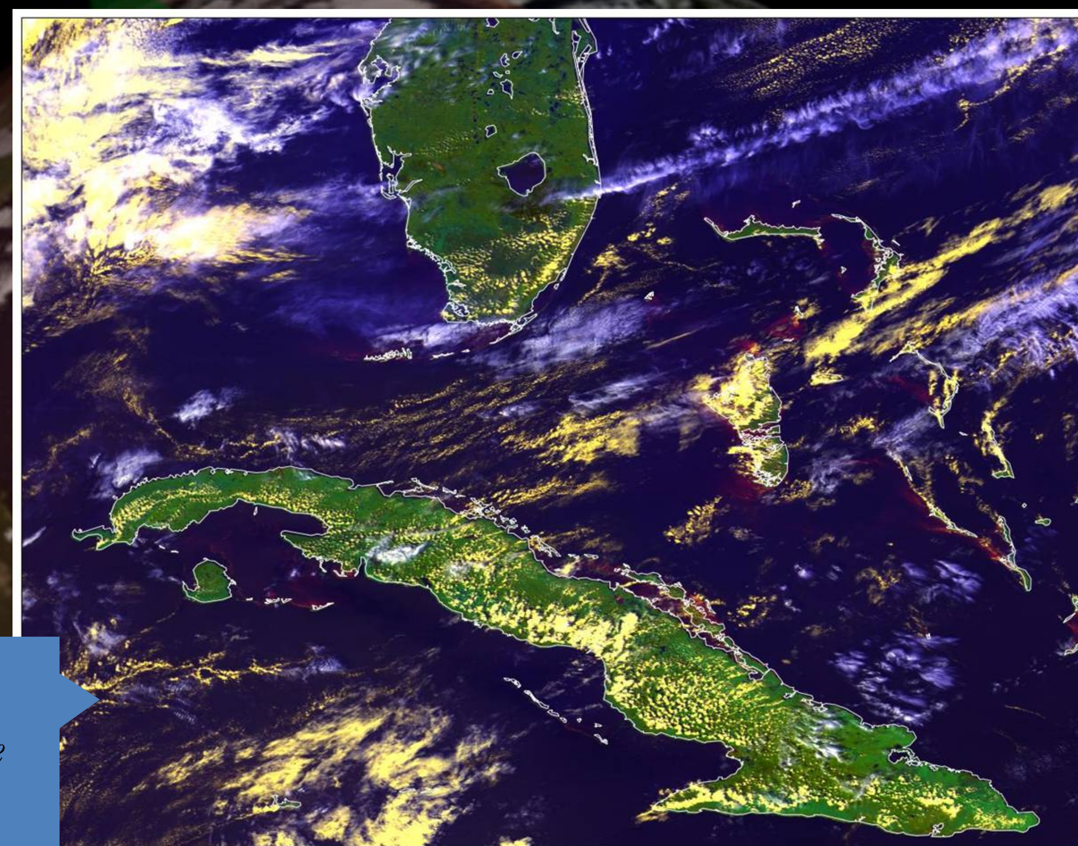
the satellites in low altitude polar orbit


1990
2010
Soundings
Snow / Ice
Imagery
Soundings
Sea Sfc Temp
Snow / Ice
Imagery
Winds
ERB
Ozone
Precip
Veg Index
Soundings
Sea Sfc Temp
Snow / Ice
Imagery
Winds
ERB
Ozone
Precip
Veg Index
Aerosol
Clouds
Microwave
Future Systems

e/near IR and IR

ver 49 years

Image from NOAA-19 polar-orbiting satellite taken February 22, 2009 from the AVHRR sensor



1950 1970 1990 2010 2030

TIROS-1-10

ESSA 1-9

NIMBUS

NOAA 1-5

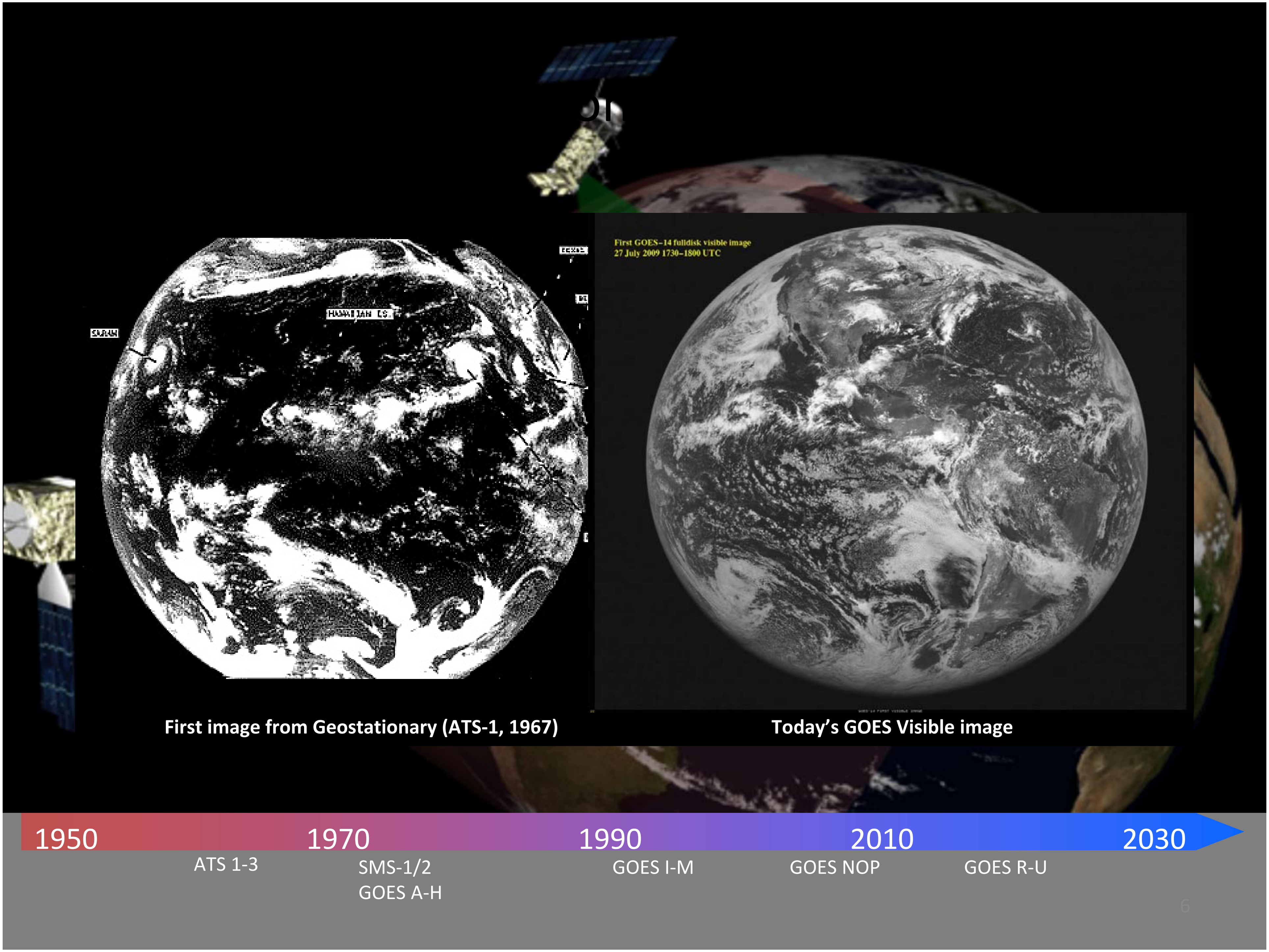
TIROS-N

DMSP

NOAA 6-19

NPP

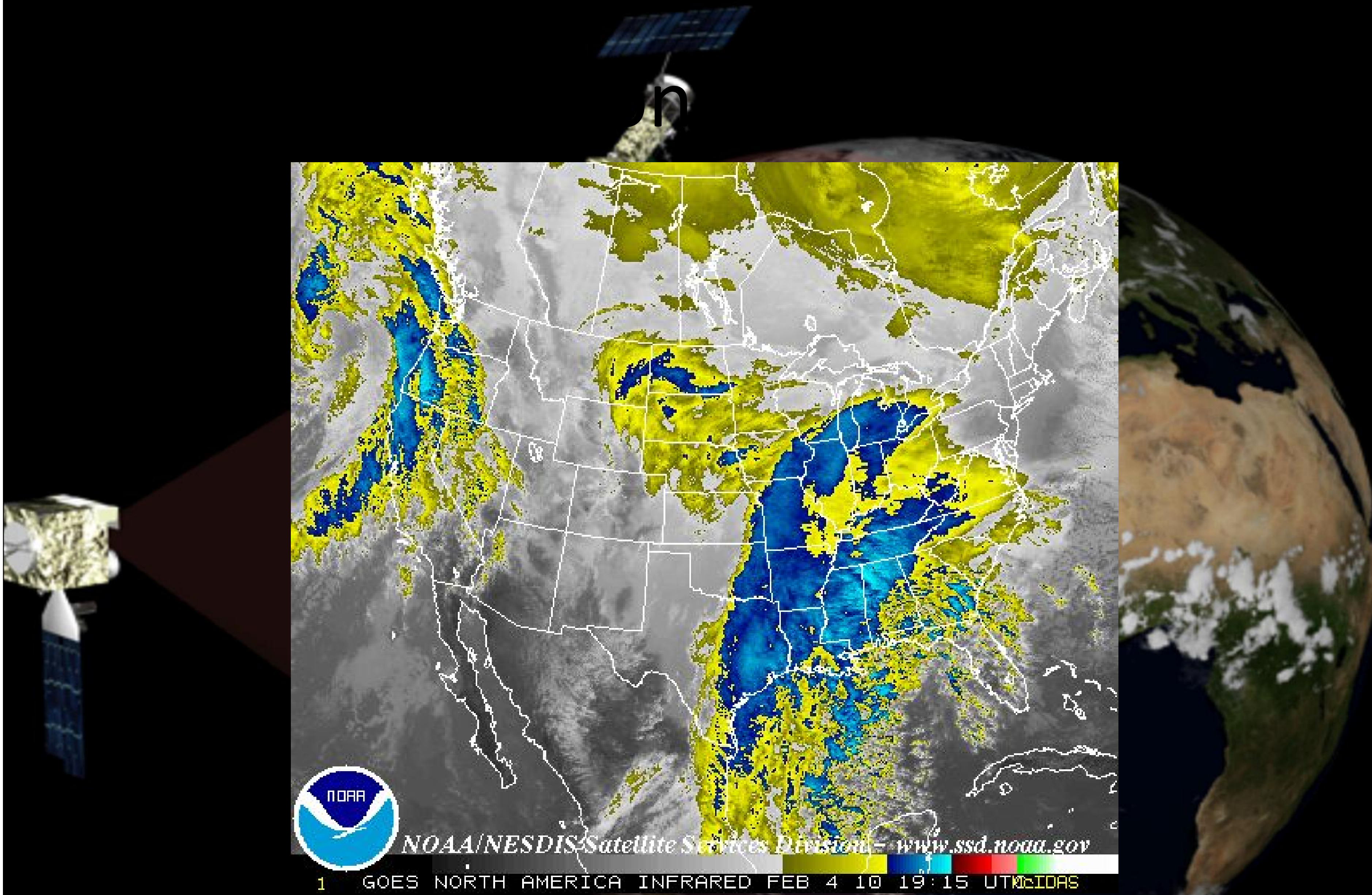
NPOESS



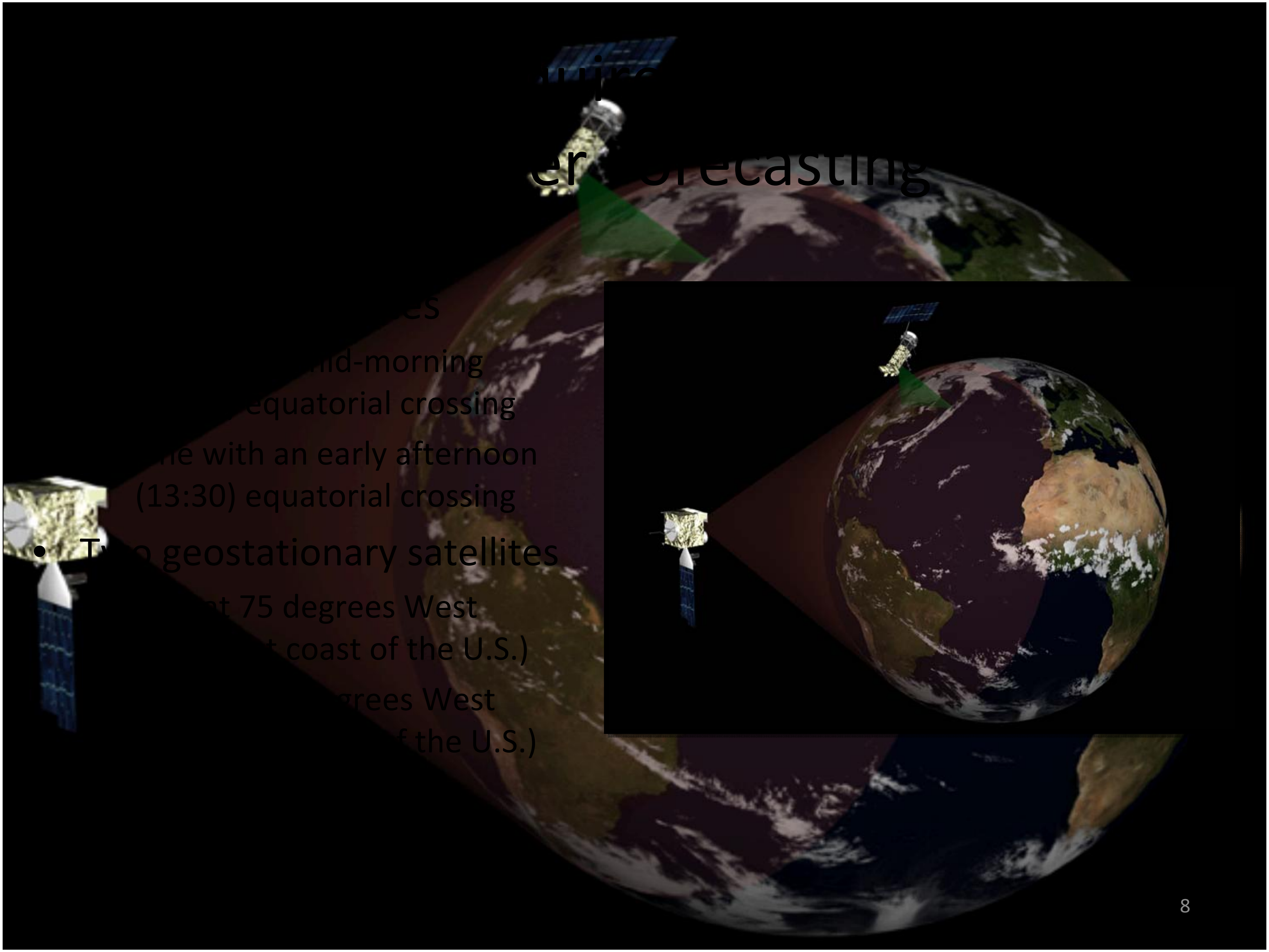
First image from Geostationary (ATS-1, 1967)

Today's GOES Visible image

on



North America, February 2010



...er Forecasting

...es

...id-morning
...equatorial crossing

...ne with an early afternoon
(13:30) equatorial crossing

- T... geostationary satellites
  - ...t 75 degrees West
  ...t coast of the U.S.)
  - ...grees West
  ...f the U.S.)

...te Observations

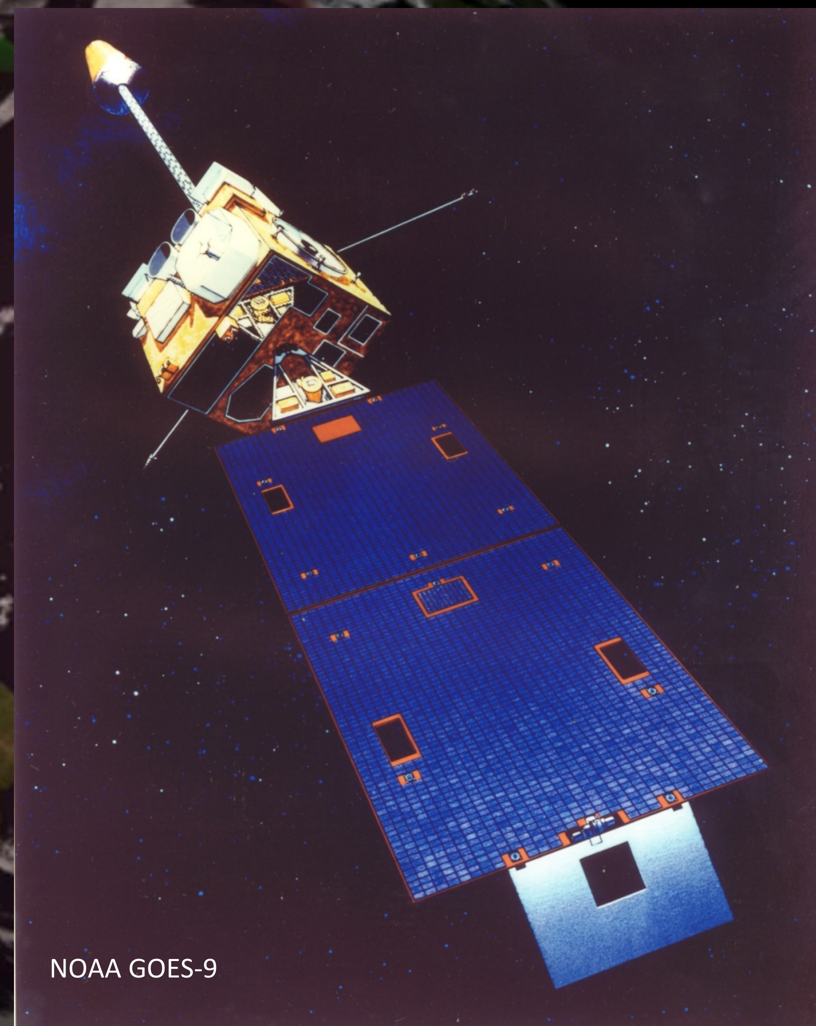
- ...te observations is critical
  - ... is an important input to numerical weather models
  - ... products are used by local weather forecasters
  - ...ellite data supports watches and warnings of severe weather
- Continuity is threatened by
  - Launch failures
  - On-orbit failures prior to the completion of satellite design life
  - Launch delays caused by satellite development problems
  - ... rapidly increasing cost of satellite development
- **International collaboration has proven to be a means of mitigating the threats to satellite continuity**

Arrangement

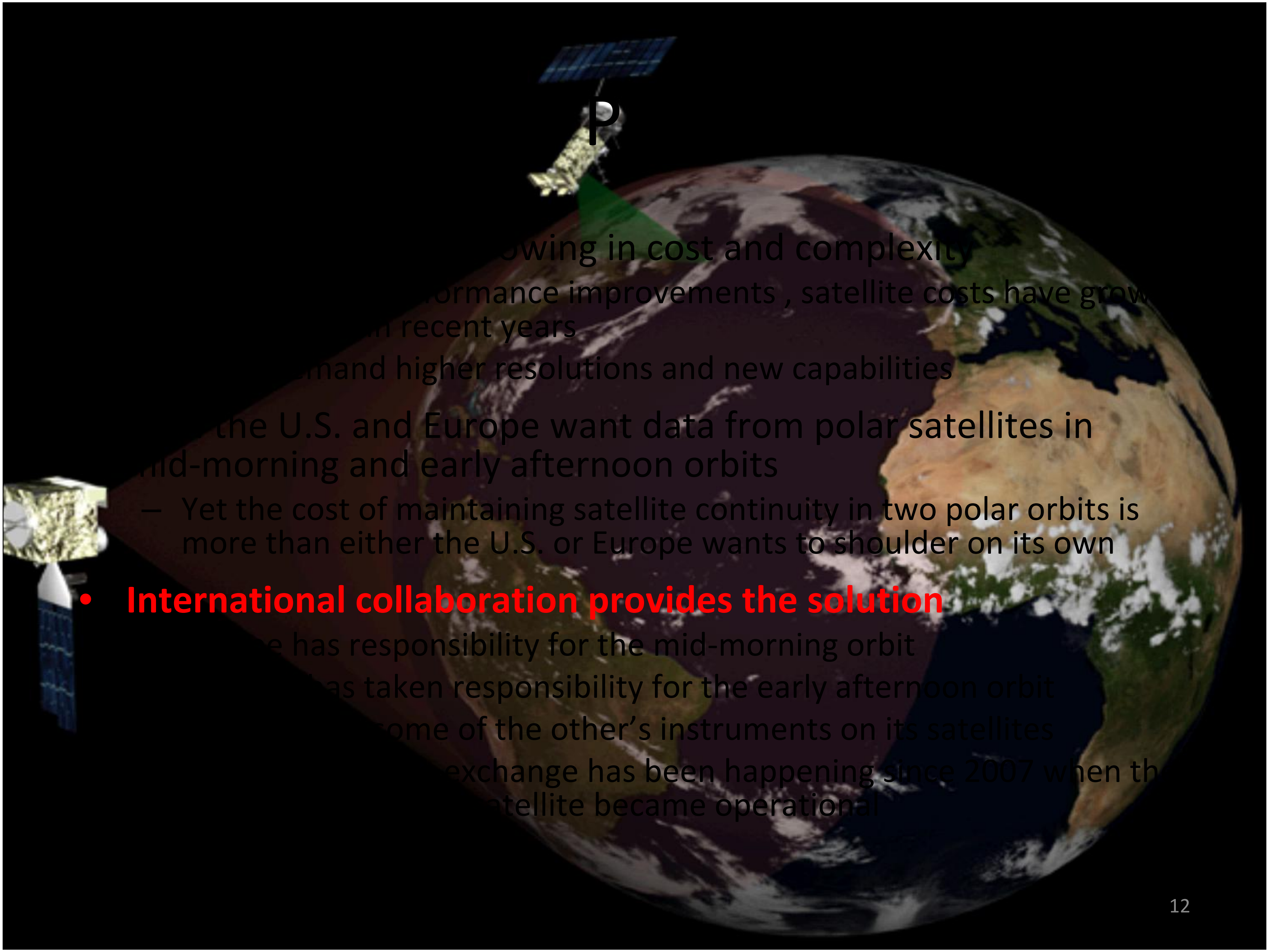
- In 1986, lightning struck the GOES-G launc vehicle, destroying the satellite
- GOES-I, the first of a new generation of satellit had major development problems causing a 5 ye schedule slip
- These events caused the GOES constellation to drop to a single satellite on orbit in 1990
- **International collaboration provided the solution**
- From 1991 to 1995, the European Meteosat-3 was operated, first at 50 degrees West, then at 75 degrees West, in support of the U.S.
- Data from Meteosat-3 was especially importan forecasting the landfall and intensity of Hurri Andrew in 1992

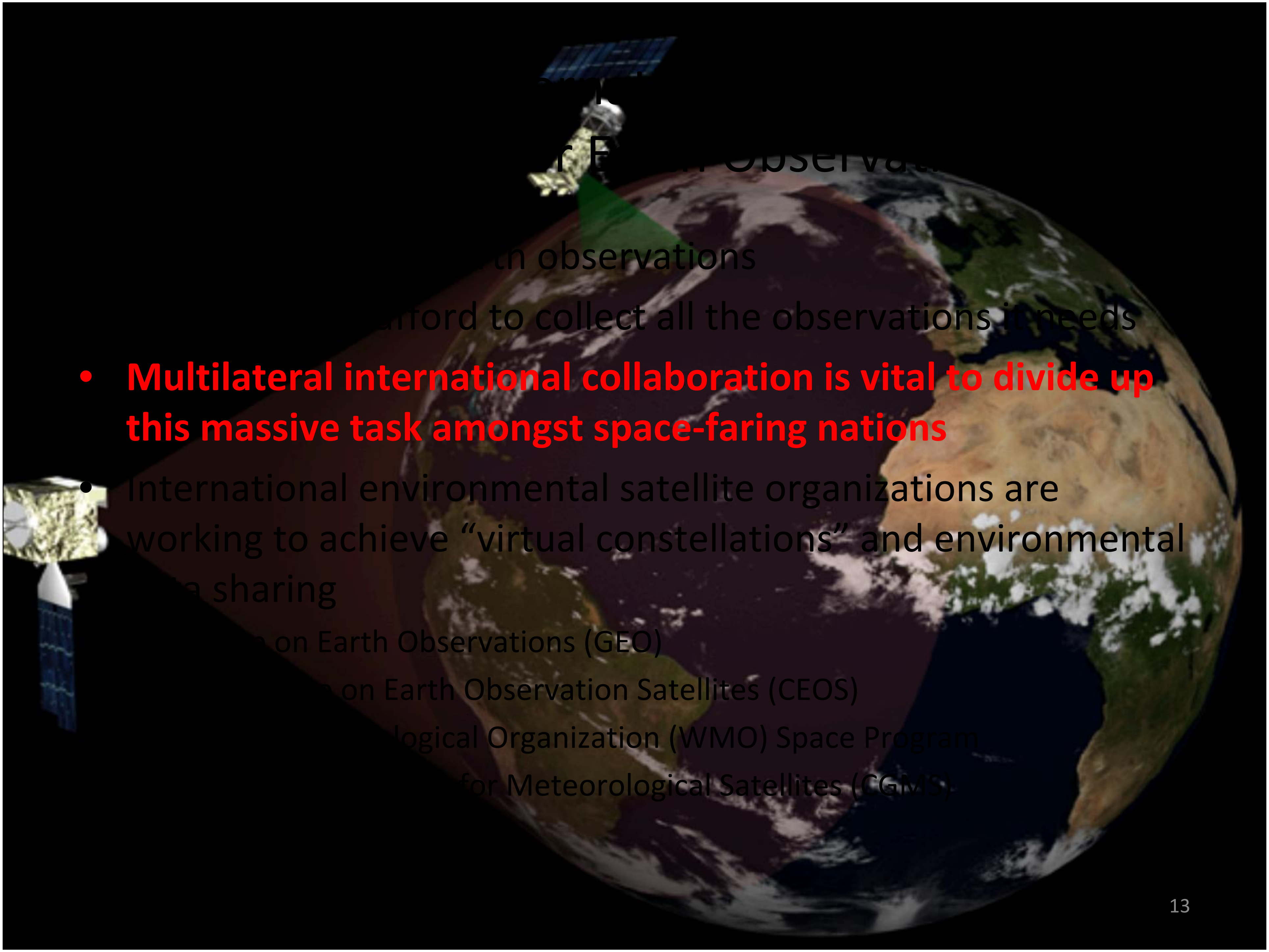
…ose-C…
…Arrangement

- …ement for …S-5 satellite, had …99.
- **International collaboration provided the solution**
- …n 2002, the U.S. agreed to provide backup for GMS-5
- …e U.S. moved GOES-9 westward to …st in 2003
- …ed MTSAT-1R in February
- …erate at 155° East



NOAA GOES-9


P
owing in cost and complexity
ormance improvements , satellite costs have grow
recent years
mand higher resolutions and new capabilities
the U.S. and Europe want data from polar satellites in
id-morning and early afternoon orbits
– Yet the cost of maintaining satellite continuity in two polar orbits is more than either the U.S. or Europe wants to shoulder on its own
• International collaboration provides the solution
e has responsibility for the mid-morning orbit
as taken responsibility for the early afternoon orbit
ome of the other’s instruments on its satellites
exchange has been happening since 2007 when th
tellite became operational



r Earth Observati

th observations

ford to collect all the observations it needs

- **Multilateral international collaboration is vital to divide up this massive task amongst space-faring nations**
- International environmental satellite organizations are working to achieve "virtual constellations" and environmental ta sharing
  - on Earth Observations (GEO)
  - on Earth Observation Satellites (CEOS)
  - logical Organization (WMO) Space Program
  - for Meteorological Satellites (CGMS)