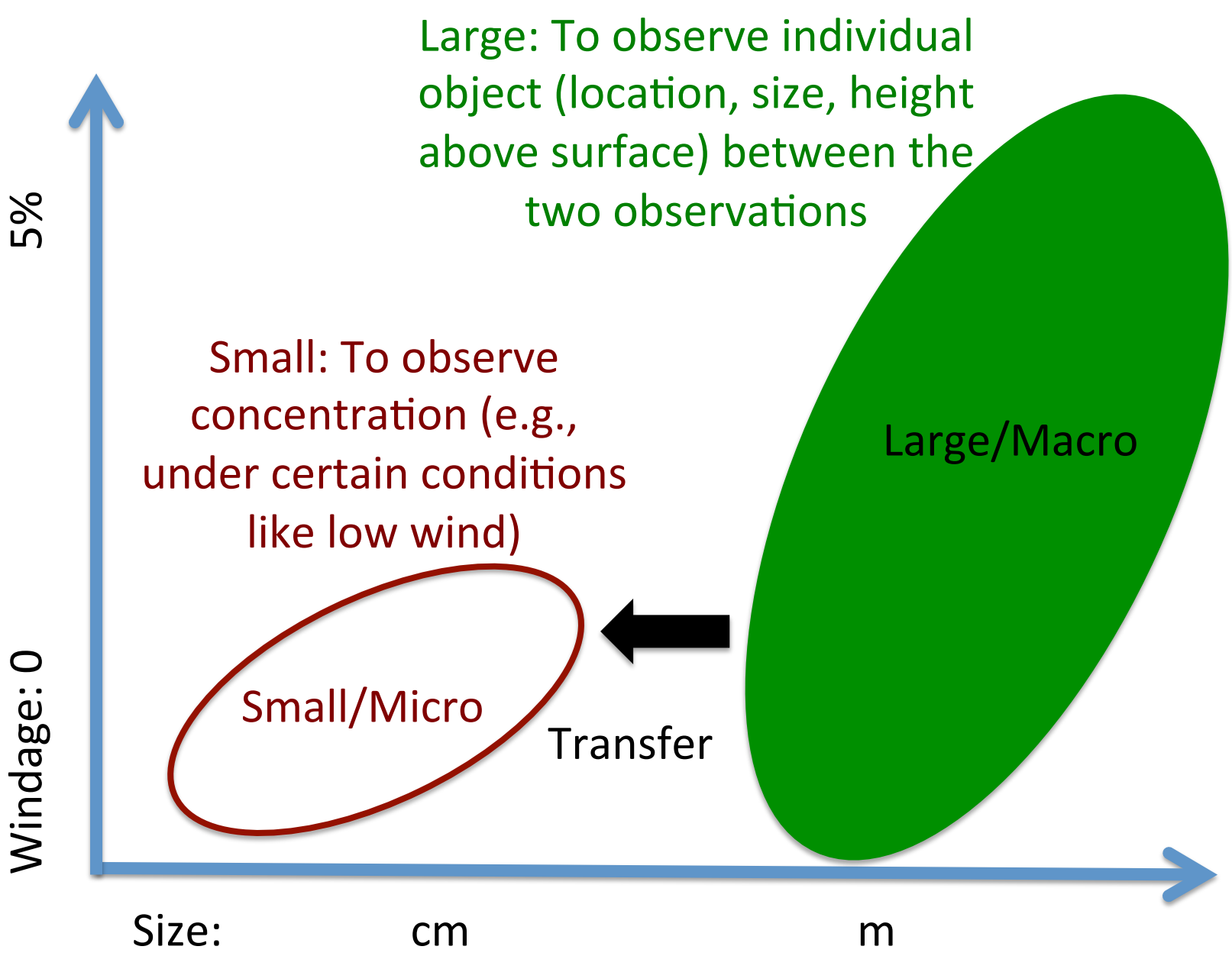
Marine Debris Mission:

From observation to understanding and prediction in order to inform decision making

- Unique characteristics
  - An important societal and policy problem
  - A new science but complex problem
    - Meteorology (near surface)
      - Wind (from 10-m to surface)
    - Oceanography
      - Current (from surface to 15-m)
      - Vertical mixing
      - Sub-pixel scale process/parameterization
    - Windage (0-5%)
  - A challenging technology problem
    - Mission impossible for technologists/engineers

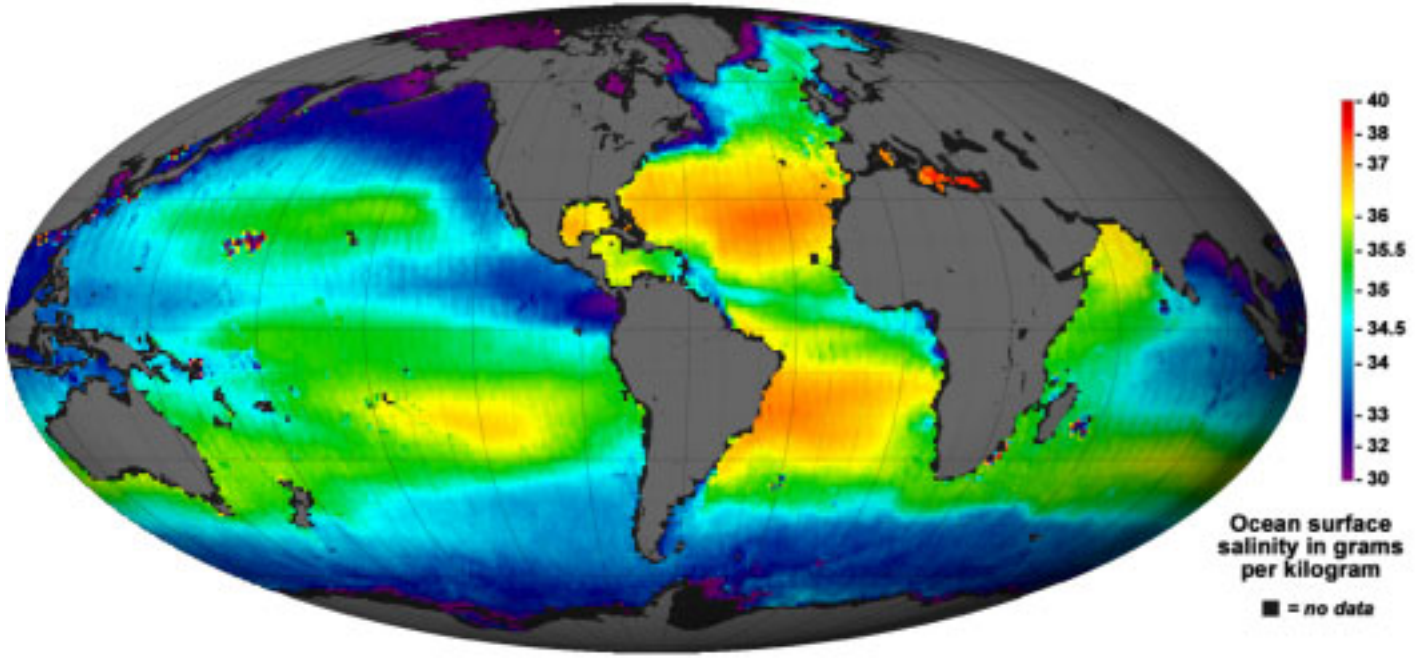

Large: To observe individual object (location, size, height above surface) between the two observations
Small: To observe concentration (e.g., under certain conditions like low wind)
Large/Macro
Small/Micro
Transfer
5%
Windage: 0
Size:
cm
m

Science Objectives

- Observe the size-frequency distribution and variability for large/macro debris (for the first time; space debris example)

Discovery

Aquarius Salinity



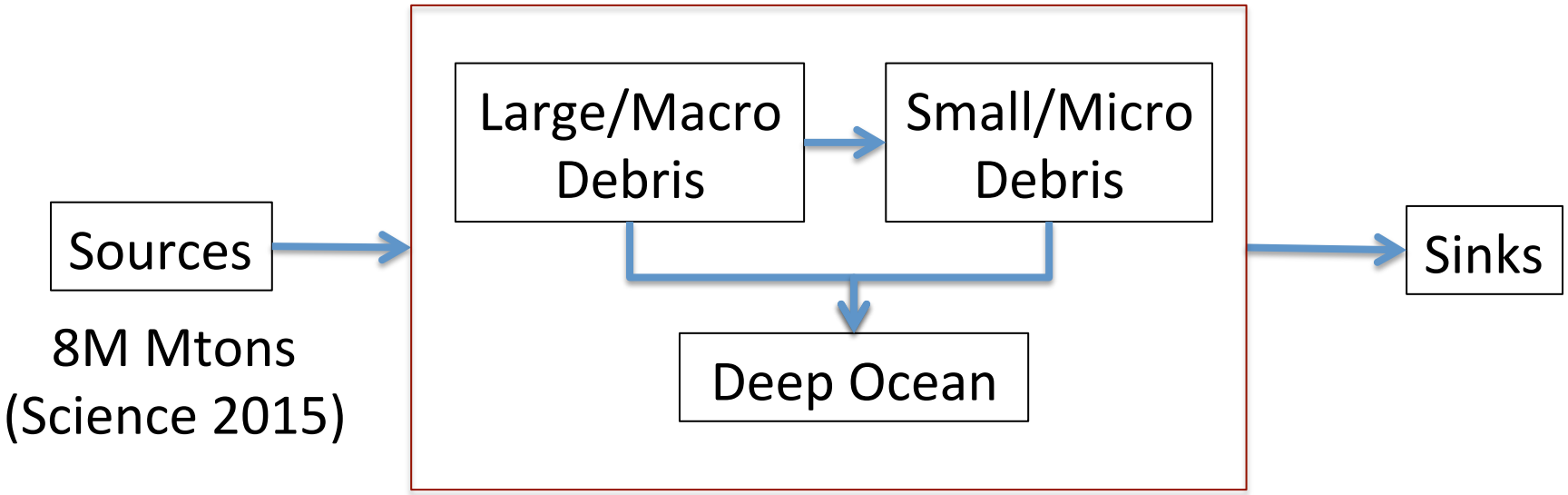
Space Debris Map

Science Objectives

- Observe the size-frequency distribution and variability for large/macro debris (for the first time; space debris example)
- Quantify the mass balance including as much as possible small/micro debris (using water cycle and carbon budget as examples) and reduce the uncertainty of today's state-of-the-art estimate (an order of magnitude)

Linkage between large/macro and small/ micro debris; surface and deep ocean

- What is the transfer function from large/macro to small/micro debris?
- Is there a correlation between the two?
- Can we reduce the uncertainty for today's estimate (e.g., Science paper in 2015)



Science Objectives

- Observe the size-frequency distribution and variability for large/macro debris (for the first time; space debris example)
- Quantify the mass balance including as much as possible small/micro debris (using water cycle and carbon budget as examples) and reduce the uncertainty of today's state-of-the-art estimate (an order of magnitude)
- Develop the transfer function from open ocean to shoreline through the coastal and the deep ocean
- Inform the decision making process (e.g., targeted cleanup, behavior change, fishing net redesign to reduce loss); education and public engagement

From the open ocean to shoreline through the coastal ocean

PARTICIPATING COUNTRIES

Argentina
Aruba
Australia
Bahamas
Bahrain
Bangladesh
Barbados
Belize
Bermuda
Brazil
Canada
Cayman Islands
China
Colombia
Costa Rica
Cuba
Cyprus
Czech Republic
Denmark
Dominica
Dominican Republic
Ecuador
Egypt
Estonia
Finland
Greece
Grenada
Guatemala
Guyana
Honduras
Hong Kong
Hungary
India
Indonesia
Israel
Jamaica
Japan
Kenya
Latvia
Libya
Malaysia
Malta
Marshall Islands
Mexico
Mozambique
Netherlands Antilles
Nevis
New Zealand
Norway
Palau
Panama
Peru
Philippines
Poland
Republic of Korea
Russia
Saudi Arabia
Singapore
Slovakia
South Africa
Sri Lanka
St Vincent & Grenadines
St. Kitts
St. Lucia
Taiwan
Tanzania
Thailand
The Palestinian Territories
Trinidad and Tobago
Turkey
United Arab Emirates
United Kingdom
United States
Uruguay
Venezuela
Vietnam

Indicates new country participation for 2007.

Science Measurement Requirements

- Global mapping
  - What is the spatial distribution of MD? (1st global map!)
  - How does MD change with time? (e.g., seasonal cycle, year-to-year variability, long-term trend)
- Sink
  - Where does MD end up? (e.g., hot spots, amount, extreme events)
    - How to link the open ocean observations (and modeling) to shoreline through the coastal ocean
      - Complementary to shoreline survey (e.g., ICC, local groups)
    - What is the transport from the surface to the deep ocean?
- Source
  - Where does MD come from? (from rivers and watershed on the global scale)

Instrument Functional Requirements

- Passive
  - Optical
  - Infrared
  - Multi-/hyper-spectral
- Active
  - SAR
  - Laser based (Raman-based spectroscopy)
- To be compared and others to be developed

Future Plans

- Publish talks on web site (contact Nikolai if you have concerns)
- Draft/prepare/publish white paper (outline, comments, final; report, news article, journal)
- Establish NASA MD community in collaboration with other agencies and international organizations (e.g., ESA, UNEP)
  - Web site, mailing list, webinar, etc.
- Identify near-term tasks and organize working groups
  - What is the scale separating large/macro from small/micro debris
  - Draft/refine science traceability matrix
  - Identify gaps and missing expertise
  - …???...
- Opportunities
  - Near-term: NASA ROSES, NOAA MDP, others???
  - Medium-term: Venture/Suborbital, CubeSat, ???
  - Long-term: Satellites
- Plan for the follow-up workshop (6-12 months; Big Island/Maui)