Science Team Introduction

Sea Surface Temperature Science Team

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NASA Headquarters: Physical Oceanography Program
THANK YOU! To the Steering Team

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(and special thanks to Dick Reynolds and Peter Hacker)
Outline

• NASA’s idea of the role of “Measurement” Science Teams.
• Leadership of the team and succession.
• Composition of the team – NASA funded, NOAA and other agencies, others.
• Prospects for funding SST Science (priorities, issues, timing....)
• Future meetings (annual, TBD) and intersessional activities (special sessions at AGU etc, TBD)
“Measurement-based” Science Team

- NASA Earth Science Division satellite projects require scientific guidance for ongoing mission success and to assure the high quality of their data products. Science teams are the well-established mechanism for obtaining this guidance.

- Teams are an amalgamation of scientists from all NASA-funded or accepted international and interagency investigations. Solicited periodically through ROSES.

- Teams generally meet once per year to share research progress and meet in specialized sub-groups to address NASA project needs.

- Teams, in many cases, have evolved over the last decade from “mission” teams to “measurement” teams.
“Measurement-based” Science Team

• NASA Physical Oceanography Program has several specialized “measurement” science teams:

  • *Ocean Surface Topography Science Team* – altimetry, geodesy and oceanography for derivation of sea level-related measurements. (handling - Jason, Jason-2, SWOT).

  • *Ocean Vector Winds Science Team* – scatterometry, passive microwave radiometry, and in situ observations for derivation of wind-related measurements (Quikscat, Windsat, ASCAT, DFS).

  • *Ocean Salinity Science Team* (*new*) – microwave radiometry, ancillary remote sensed data, and in situ observations for derivation of ocean surface salinity (Aquarius, SMOS).
“Measurement-based” Science Team

- NASA has identified the need for organization of scientific advise and guidance through a Sea Surface Temperature Science Team:
  - Need to support ongoing and future NASA missions and SST products.
  - Need to improve quality of SST products through better uncertainty estimates and fund projects to reduce sources of error.
  - Need to provide a forum for development and collaboration in the USA for SST Science.
  - Need a US science group to provide advocacy and advise on the requirements for a SST observing system.
  - Need a US science group to serve as a focal point for further international scientific coordination (through GHRSSST and other international mechanisms).
“Measurement-based” Science Team

- Other NASA Physical Oceanography Science teams are conceptually organized around the uncertainty budgets for production of their primary geophysical data products (i.e. sea level, ocean surface vector wind, sea surface salinity)
- SST Science Team will be organized around the uncertainty budget that was drafted at last year’s workshop in Rhode Island. Peter Cornillon will brief that shortly.
- A perennial question is about the role of science and applications-related research to the uncertainty budget.
  - The Program belief is that EVERY funded study contributes to our understanding of uncertainty. Science and applications with SST products uncover error sources or issues with products.
  - If you are struggling with uncertainty budget concepts or your role in the science team, let’s solve it this week!
Leadership of the Team

- Other NASA Science Teams are led by a “Team Leader” and a “Project Scientist.” The Program Scientist makes these assignments.
- The role of the Team Leader is to organize the team meetings, publications, special sessions and be the primary representative of the external scientific community to the NASA mission project(s).
- The role of the Project Scientist is the lead scientist on a NASA mission and liaison with a science team that contributes to the mission success.
- Examples
  - International Ocean Vector Winds Science Team (US Leader: Mark Bourassa; QuikSCAT Project Scientist: Ernesto Rodriguez)
  - Ocean Salinity Science Team (US Team Leader: Gary Lagerloef; Aquarius PI: Gary Lagerloef)
  - International Ocean Surface Topography Science Team (US Leader: Lee Fu; Jason-2 Project Scientist: Lee Fu)
- Sea Surface Temperature Science Team: Team Leader: Peter Cornillon; Team Leader Elect: Andrew Jessup; Project Scientist(s): TBD
Composition of the Team and relationship to GHRSST

• Composition of the US SST Science Team
  – Formally, NASA-funded SST-related Principal Investigators and Co-Investigators
  – By association, NOAA-funded SST-related R&D Principal Investigators
  – Any others who focus on characterizing, understanding, and potentially reducing uncertainty in SST estimates using NASA satellite products.

• Relationship of the Team to GHRSST
  – The US SST Science Team is formed to complement GHRSST.
  – GHRSST is international and has made enormous contributions to SST data flow, metadata, and data management.
  – The focus of NASA Physical Oceanography program is understanding of the ocean circulation and its relationship to climate. The aim here is to develop and understand SST products AND demonstrate their utility in oceanography and climate research.
Prospects for future funding

- So far most new NASA investigations have originated out of the Physical Oceanography Program and the TERRA/AQUA competitions (MODIS-related SST work).
- Other sources have produced some investigations – US Participating Investigator Program, National Oceanographic Partnership Program, Interdisciplinary Science Program, etc.
- A dedicated source of SST funding and a special ROSES call for SST investigations is not yet a reality. By better organizing SST investigations, we hope to expand the scope of the endeavor.
- Collaboration and coordination with other teams is also a possible avenue for funding:
  - SST and winds (ala Chelton, Xie, and others)
  - SST and sea level (PDO, AMOC, etc)
  - SST and salinity (Aquarius and SPURS field program are the dominant opportunities of the next 2 years)
Future meetings

• Annual meetings
• Would like to choose a month and stick with it (November)
• Special sessions (ala Ocean Sciences 2012) - need organizers
• Dedicated workshops are also possible (likely focused on a particular aspect of error budget) if they would have impact
BACK-UP SLIDES
Ocean Surface Topography from Jason

- Atmospheric Refraction Corrections
  - dry gases
  - water vapor
  - ionospheric electrons

- Instrument Corrections
  - tracker bias
  - waveform sampler gain calibration biases
  - antenna gain pattern
  - AGC attenuation
  - antenna mispointing

- External Geophysical Corrections
  - inverse barometer effect
  - tides
  - geoid height
  - orbit height

- Air-sea Interface Corrections
  - EM bias
  - skewness bias

- $h_d = H - h - h_g$

- Sea Surface
- Marine Geoid
- Reference Ellipsoid
- Bottom Topography

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Ocean Surface Topography from Jason

- **Backscatter and Wind Speed Algorithms (Chairman: Trevor Guymer)**
  - 1. backscatter algorithms
  - 2. wind speed algorithms

- **Instrument and Air-Sea Interface Algorithms (Chairman: Meric Srokosz)**
  - 1. tracker algorithms
  - 2. EM and skewness biases
  - 3. antenna mispointing error
  - 4. gain calibration

- **Atmospheric Refraction Corrections (Chairman: Philip Callahan)**
  - 1. ionospheric correction
  - 2. dry tropospheric correction
  - 3. wet tropospheric correction

- **External Physical Corrections (Chairman: George Born)**
  - 1. ocean and solid earth tides
  - 2. static inverse barometer
  - 3. geoid
  - 4. precision orbit determination
  - 5. height bias residual

**WOCE Altimetry Workshop 9/1987**

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Ocean Surface Topography from Jason

**Satellite Orbit Accuracy**

Error (cm)

- best fitting exponential
- error reduced by 2 every 5 years

Lefebvre & Stewart Venice March 2006 (21)

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Ocean Surface Topography from Jason

Error budgets depend on Application
• Sea level rise estimates (CDR estimates, 1mm/yr challenge)
• Large-scale air-sea interaction and climate - global warming, ENSO, etc (1 cm challenge)
• Meso-scale eddies and coastal zone applications (spatial variability of corrections)

Error budgets depend on Measurement System (even if seemingly identical)
• What is the current understanding of both measurement noise and systematic errors? (e.g. EM Bias)

Error budgets depend on Physics
• Is the model function built on incomplete physics or no physics?

Error budgets depend on Cal/Val
• Altimetry cal/val sites leave us with systematic differences that are not explained.
  • Etc,,,,,