Summary of the High Winds SMOSSTORMS (Extreme Winds) Workshop

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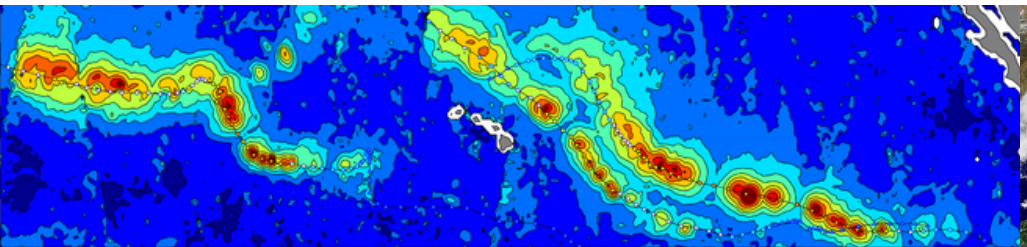
and input from many participants

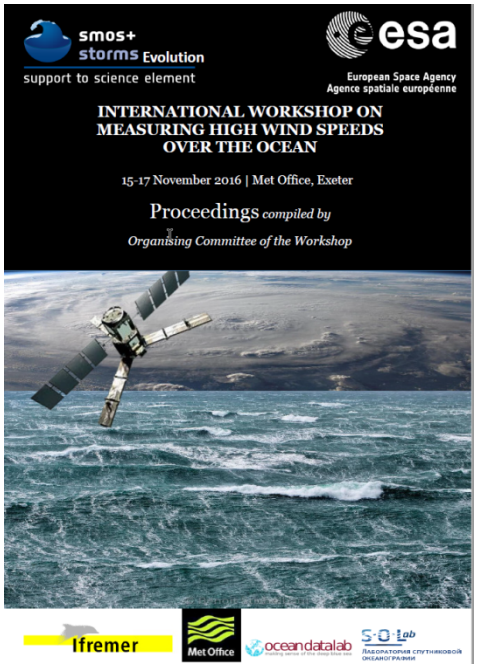
* All the organizing was done by the coauthors

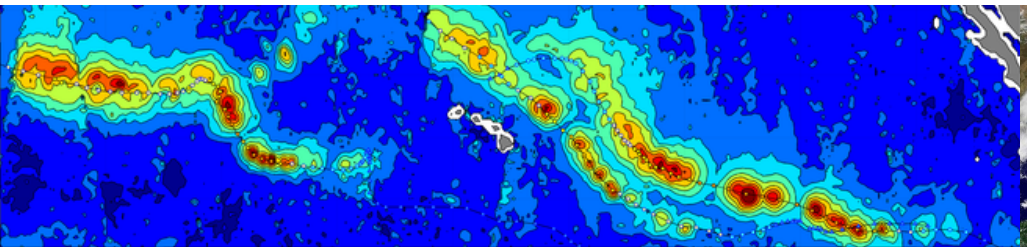



International workshop on measuring high-wind speeds over the ocean

- Hosted 3-day workshop at the Met Office in Exeter (15-17 Nov 2016)
- ~70 attendees (60 external)
- Scatterometer, radiometer (SMOS, SMAP) and applications communities
- Presentation slides available online (linked from agenda)

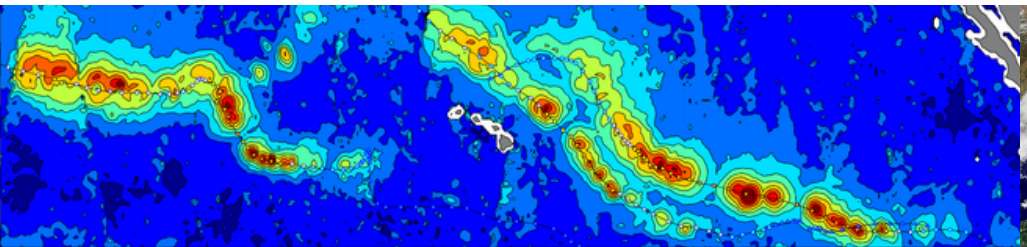
  http://www.smosstorm.org/News-Outreach/High-Wind-Workshop-presentations-now-available
- Proceedings document compiled by James Cotton





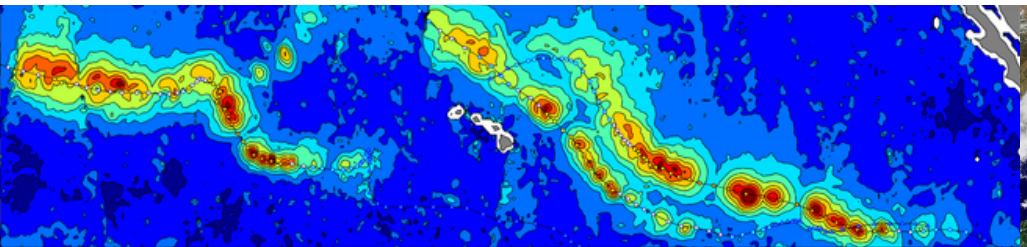
Workshop Sessions

1. Satellite measurement techniques (L-band, Radiometer, Scat, SAR, GNSS-R)
2. Applications – TC radii, HWIND, intensification prediction, wind energy
3. Calibration and validation of high winds
4. Air-sea interactions at extreme wind speeds (wind stress, sea state, gas flux)
5. Numerical Weather Prediction and Ocean Prediction (Met Office, ECMWF, wave models)
6. Future directions



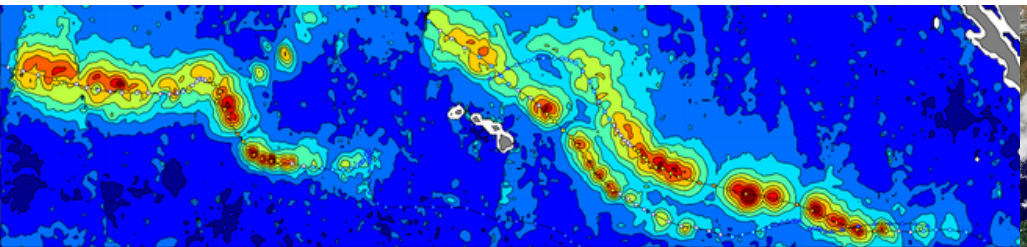

1. Observational Capability Desires

- Finer resolution from satellite observations
  - Better resolve gradients, spatial derivatives, storm structure, closer to coast
  - SAR acquisitions not frequent enough
- Scatterometery and radiometry can be made consistent and used to transfer calibration to other instruments
  - Orbit selection that allows for crossing swaths of data
- Observations are required to better understand the physics of air sea coupling at high wind speeds (>25ms^{-1})
- Waves collocated with winds (model waves insufficient?)



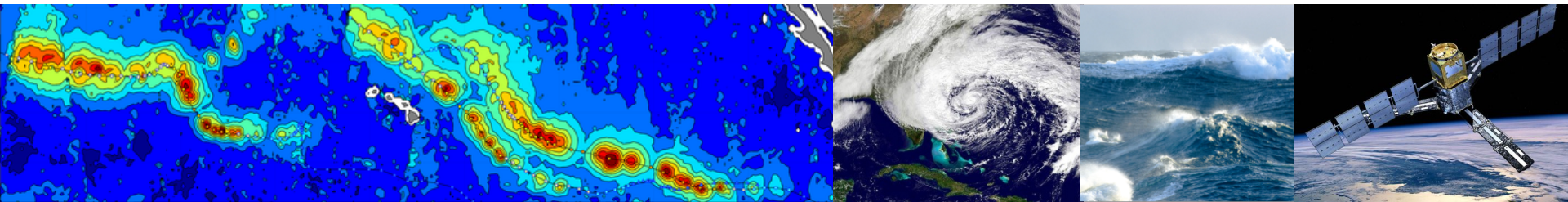

2. Calibration and Validation

- It was agreed that dropsondes WL150 wind speeds will be our standard for the 'truth'
  - NOAA/HRD to document and check accuracy outside eyewall
- SFMR winds will be the transfer mechanism from dropsonde winds to satellite winds
- Requires spatial averaging of SFMR to provide comparison data on the scale of satellite measurements
- Data too near the radius of maximum winds are likely to be substantially influenced by sea state
- NOAA/NESDIS have reprocessed Winter Storms SFMR from 2006 onwards - method for calibration of SFMR winds (antenna temp corrections) to be made available by early 2017 ✓ Pending
- NOAA/HRD has reprocessed tropical SFMR data set ✓



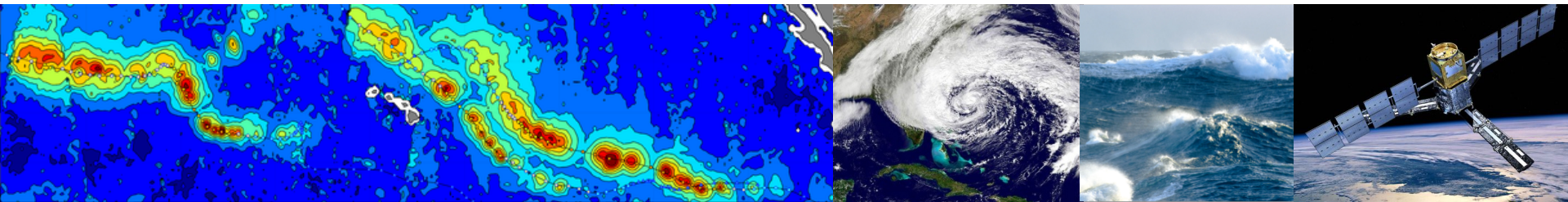

3. Intercalibration of Data Sets

- SFMR to satellite; satellite to satellite;
  - continually improving calibration is an IOVWST goal
- A lot to learn by analysing differences/similarities between passive and active MW measurements
- Two wind regimes of strong interest
  - overlap range between L-band, C- and Ku-band (15-32 ms^{-1})
    - Start where products are similar and then move to higher wind speeds as sufficient comparison data exist
  - high wind regime (>32 ms^{-1})
- Suggest values of wind radii of 34/50/64 kt (used by forecasters) be part of this intercomparison



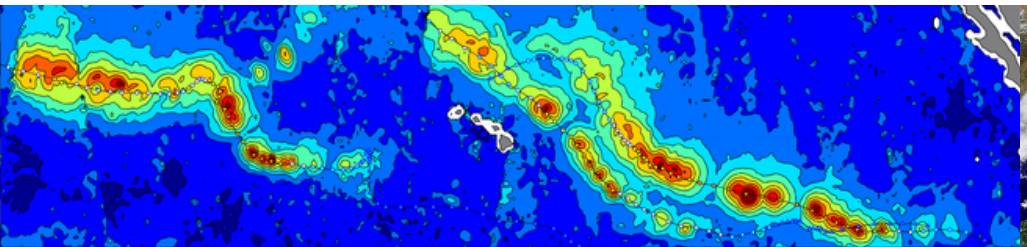
Tasks to Move Forward (I)

- 3 activities towards a common calibration, intercomparisons of
  - Extratropical Cyclones (1st, easier to understand)
  - Tropical Cyclones
  - SFMR intercomparison of historical observations
- To coordinate aircraft flights into storms with satellite overpasses (where possible)
  - SFMR, Dropsondes, IWRAP
  - Plan Sentinel acquisitions to overlap?
  - NOAA expt. Ireland/N. Atlantic 2017
- **Follow up at IOVWST / future HW meetings**
  - **Decide intercomparison framework and circulate draft plan**

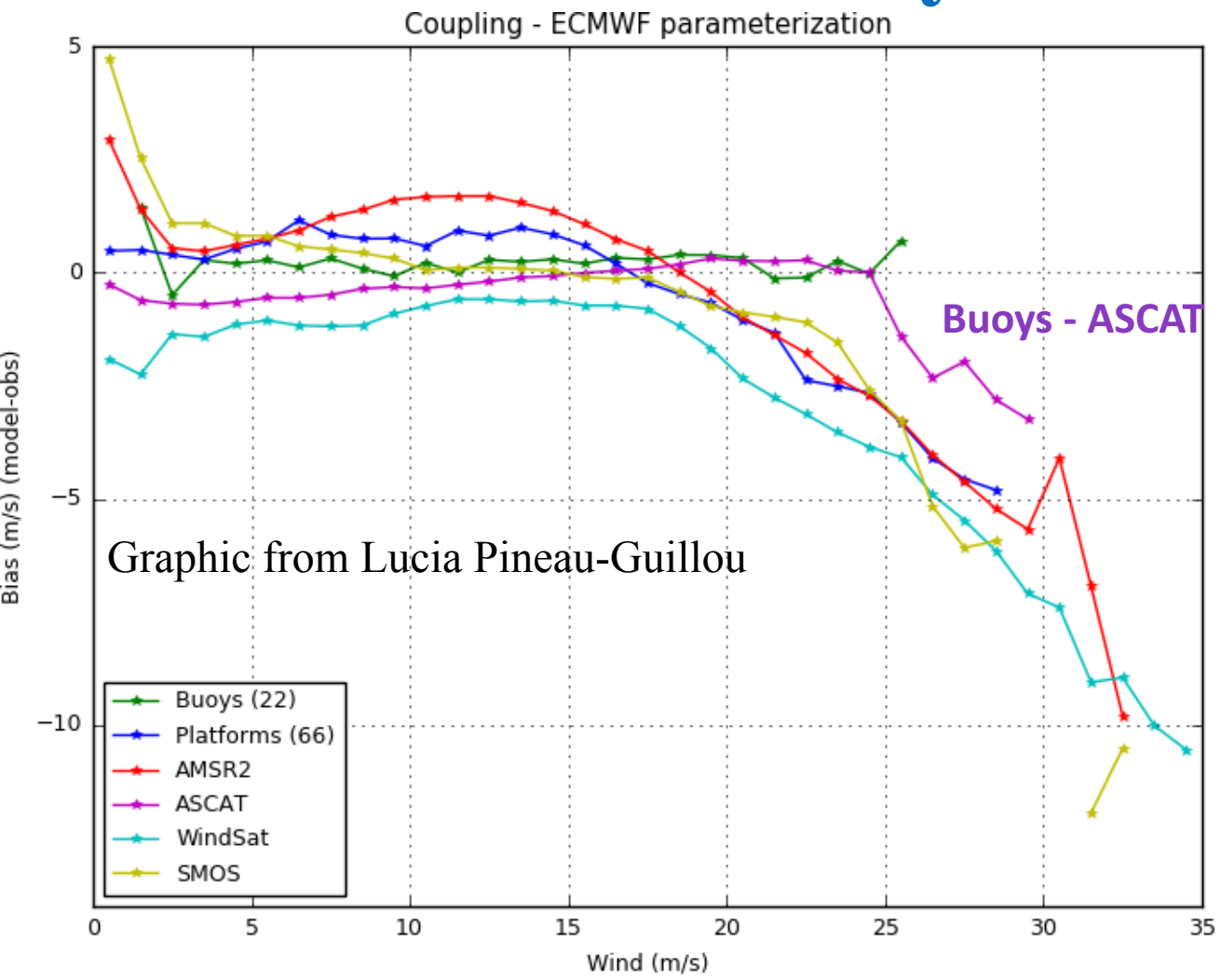


Tasks to Move Forward (II): Data

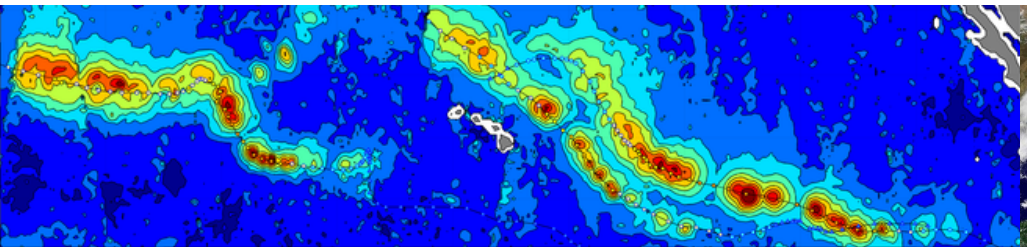
- Make surface wind data sets more easily available and easier to work with (format, QC, calibration)
  - Mostly achieved for satellite data but work to include new sensor communities (e.g. CYGNSS)
  - Other data sets e.g. SFMR, dropsondes, research ships, VOS, buoys, oil rigs, assigned to named people to make progress on
    - US Research vessels with winds >20 ms^{-1}
      - http://coaps.fsu.edu/RVSMDC/html/highwind.shtml ✓
    - VOS collocations under development
    - Oil Rig data acquired for testing




ASCAT and Buoys are Different

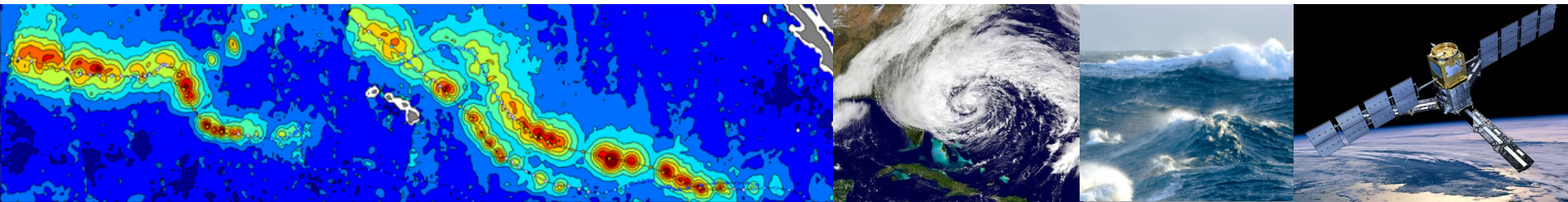


- Different does not mean bad
- ASCAT is very well calibrated to buoys
- But buoys are questionable (likely biased) at high wind speeds.
- If the wave height is similar to the anemometer height, then waves change the physics and reduce the wind speed
  - Jim Edson



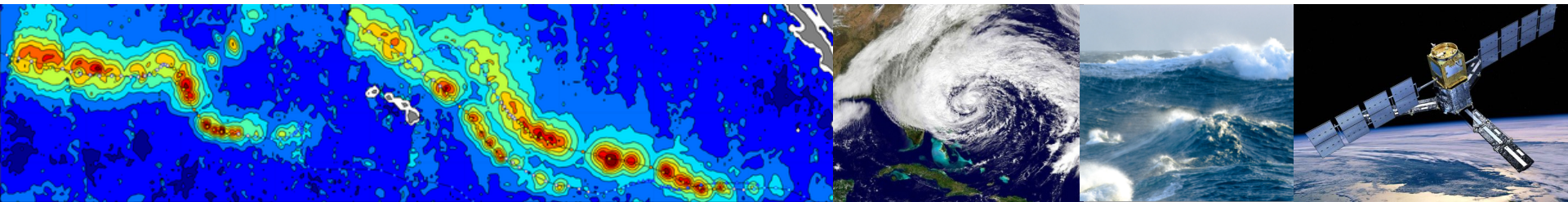
Tasks to Move Forward (III): Data Quality

- Determine the conditions for which buoy data are ‘useful’ for calibration
  - Ideally also from other in situ data sets
- Identify how much rain can be tolerated for each remote sensing instrument
  - Or characterize uncertainty due to rain & rain-related sampling
- Improve physics of air/sea coupling for high winds
  - How do we calculate an equivalent neutral wind for these conditions?
- Determine the range the distance from storm centers for which sea state has a ‘substantial’ impact on retrievals



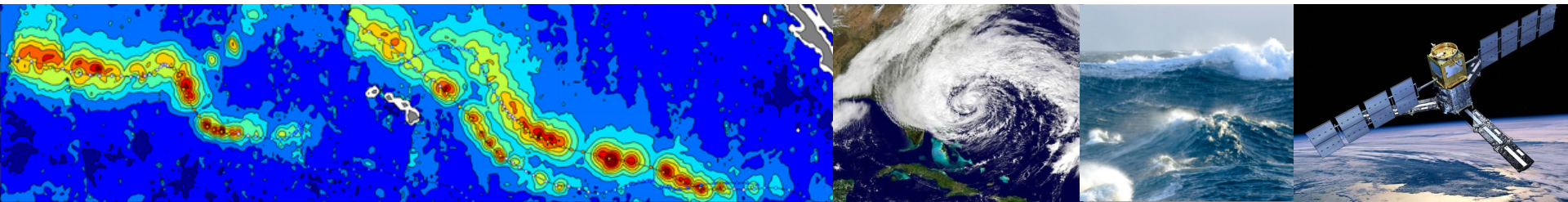
Tasks To Move Forward - Applications

- Agree on the calibration to the point were wind radii can be determined with a specified confidence (34/50/64 kts)
  - These are used operationally for hurricane forecasts
- Assimilation to consider using surface pressure



Letters of Support and Future Meetings

- SMOS and passive L-band mission continuity
  - Letter sent by Nicolas Reul to EU and ESA with collected signatures
  - Potential as future Sentinel (on list of candidates)
- IOVWST, CGMS (better)
- It was agreed that such a meeting was useful in joining radiometer, scatterometer and application communities together
- Plan to organize a HW meeting every 2 years in the future
- Suggestion to host it at Metéo France or ECMWF in 2018..



New Observations to Assess Importance Of Possible Problems

- Doppler observations of spray in the boundary-layer
  - How do the following change as a function of wind speed for extreme winds?
    - What is the sea spray distribution as a function of height?
    - Are there two (or more) boundary-layers?
    - How do wave spectra impact remote sensing?
  - Observations from either high frequency from an aircraft or mm frequency from a platform (e.g., oil rig)
  - Could an international project be developed to improve the value of a field program?
    - We would need to determine what problems could be addressed and the advantages of doing so.