Using Surface Pressure to Produce Scene-Wide, km-Scale Tropical Cyclone Surface Wind Retrievals From SAR

**Summary**
- Surface pressure retrieval methodology successfully transferred to km-scale SAR winds.
- Bulk pressure gradient methodology looks promising for improving SAR high wind retrievals.
- SLP technique allows scene-wide surface wind retrievals that improve upon standard GMF methods.

- **SAR TC Working Group Collaboration**
  - Hans Graber
  - Chris Wackerman
  - Jochen Horstmann
  - Ralph Foster
  - Roland Romeiser
  - Mike Caruso
  - CSTARS/RSMAS, U. Miami

- **Supported by NASA IOVWST and ONR Physical Oceanography:**

  **Using Surface Pressure to Produce Scene-Wide, km-Scale Tropical Cyclone Surface Wind Retrievals From SAR**

- **Surface pressure retrieval methodology successfully transferred to km-scale SAR winds**
- **Bulk pressure gradient methodology looks promising for improving SAR high wind retrievals.**
- **SLP technique allows scene-wide surface wind retrievals that improve upon standard GMF methods.**

- **Impact of Typhoons on the Pacific (ITOP) Experiment (2010)**
  - 18 SAR images of eyes and near misses
  - 9 C-band and 9 X-band, various polarizations
  - 7 with near-in-time USAF C-130 under flights (sondes and SFMR)

- **Historical Atlantic imagery from Canadian Space Agency Hurricane Watch**

- **Examples**
  - **Malakas (22 Sep, 2010, 20:30 UTC)**
    - C-130 survey
    - Weak Cat-1 typhoon
    - Within range of existing GMFs
    - Excellent comparison between SAR and C-130 observations
    - Some remaining low incidence angle problems

  - **Megi (15 Oct, 2010, 21:00 UTC)**
    - Typhoon on the Pacific (ITOP) Experiment (2010)
    - Super Typhoon, use of high ambiguity winds
    - C-130 flight survey of Typhoon on the Pacific (ITOP) Experiment (2010)
    - SFMR winds (black) and rain rate (cyan) compared to CMOD5N SAR winds (blue) and SLP winds (red).
    - C-130 flight-level estimated surface pressure (black) and rain rate (cyan) compared to CMOD5N SAR winds (blue) and SLP winds (red).

    - Super Typhoon, use of high ambiguity winds
    - C-130 flight survey of Typhoon on the Pacific (ITOP) Experiment (2010)
    - SFMR winds (black) and rain rate (cyan) compared to CMOD5N SAR winds (blue) and SLP winds (red).

- **Supporting Figures and Tables**
  - **Figure 1:** SAR TC surface winds above 30 m s⁻¹ limited by
  - In situ Cal/Val data
  - Geophysical model functions
  - Wind directions from rolls/breaks
  - Selection of directions
  - Eye location
  - Assume barometers are more reliable than anemometers in TCs
  - Sea-level Pressure (SLP) is an inherently integrated property of surface winds
  - Can we use SLP as an alternate source of surface wind Cal/Val data?
  - First step: Use SLP methodology as a scene-wide (vs. pixel-by-pixel) surface wind retrieval

- **Malakas 22:**
  - Cleanest example from ITOP
  - Close-in-time C-130 survey
  - Weak Cat-1 typhoon
  - Within range of existing GMFs
  - Excellent comparison between SAR and C-130 observations
  - Some remaining low incidence angle problems

- **Megi 15:**
  - Stronger storm than Malakas 22
  - Very compact, trial for PBL model (small errors magnify)
  - Limited range of sonde splash pressures

- **Megi 17:**
  - Super Typhoon (record low MSLP, JMA: 885 mb)
  - Severe challenge for SAR
  - Used small (<200) high ambiguity winds in order to reach reasonable MSLP
  - Hint of multiple eye wall (unverified)

- **SAR TC surface winds above 30 m s⁻¹ limited by**
  - In situ Cal/Val data
  - Geophysical model functions
  - Wind directions from rolls/breaks
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  - Assume barometers are more reliable than anemometers in TCs
  - Sea-level Pressure (SLP) is an inherently integrated property of surface winds
  - Can we use SLP as an alternate source of surface wind Cal/Val data?
  - First step: Use SLP methodology as a scene-wide (vs. pixel-by-pixel) surface wind retrieval