Sustained Satellite Surface Vector Wind Observations for Studies of El Niño

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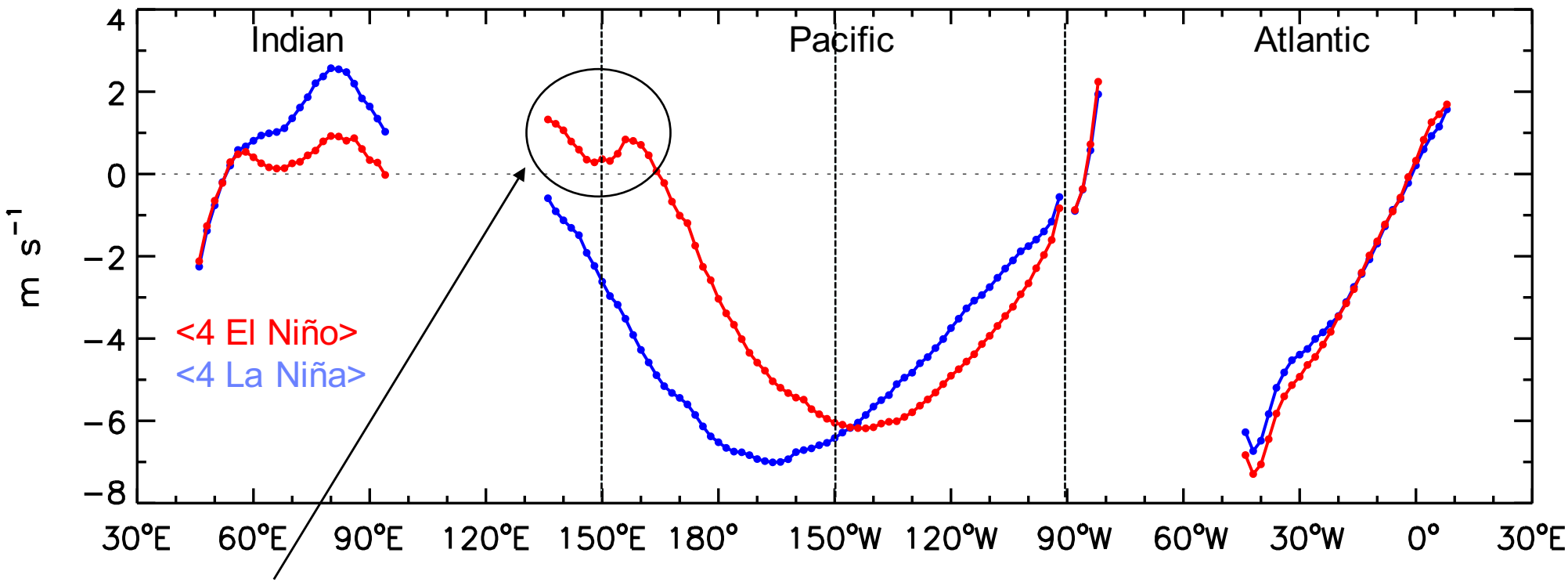
Motivation

Did the prevailing westward wind speed along the Pacific equator collapse in the super El Niño event of Mar 2015 – Jan 2016?

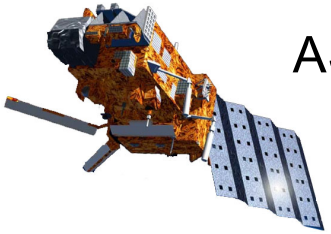


Collapse of westward wind in El Niño compared to La Niña

El Niño 1, Jun 2002 – Feb 2003 (9 mo) **Q**
El Niño 2, Jul 2004 – Apr 2005 (10 mo) **Q**
El Niño 3, Sep 2006 – Jan 2007 (5 mo) **Q**
El Niño 4, Jul 2009 – Apr 2010 (10 mo) **A**
El Niño 5, Mar 2015 – Jan** 2016 **A & R**

La Niña 1, Mar 2000 – Mar 2001 (13 mo) **Q**
La Niña 2, Aug 2007 – Jun 2008 (11 mo) **Q**
La Niña 3, Jul 2010 – Apr 2011 (10 mo) **A**
La Niña 4, Aug 2011 – Mar 2012 (9 mo) **A**

Monthly Mean Surface Vector Wind
ASCAT-A and QuikSCAT



ASCAT-A on METOP-A
Jun2007 - present

RSS V1.2 Data

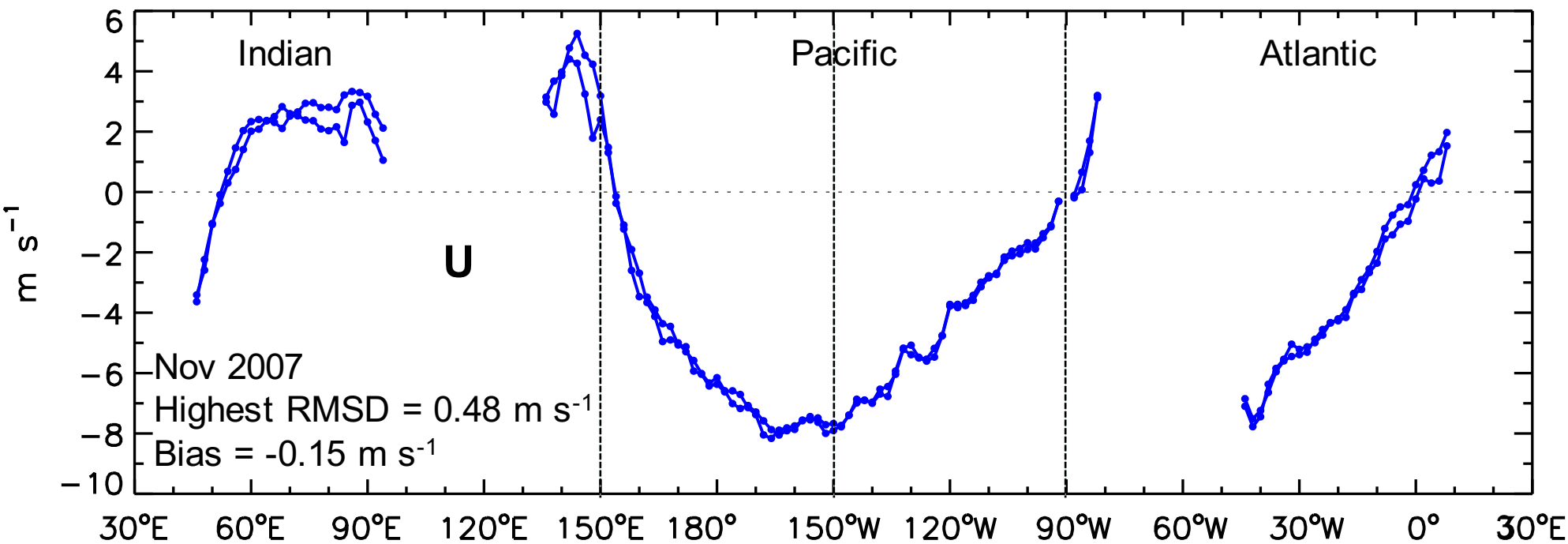
SeaWinds on QuikSCAT
Jul1999 – Oct2009

RSS V4 Data

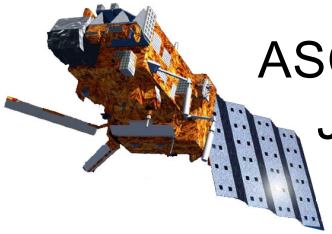
La Niña 2 (11 mo)
El Niño 4 (4 mo)

$\langle \triangle U_{A-Q} \rangle = -0.03$ m s^{-1}
$\langle RMSD \rangle = 0.38$ m s^{-1}

2°x2° grid centered on equator



Monthly Mean Surface Vector Wind
ASCAT-A and RapidScat



ASCAT-A on METOP-A
Jun2007 - present

RapidScat on ISS
Oct2014 - present

El Niño 5 (11 mo)

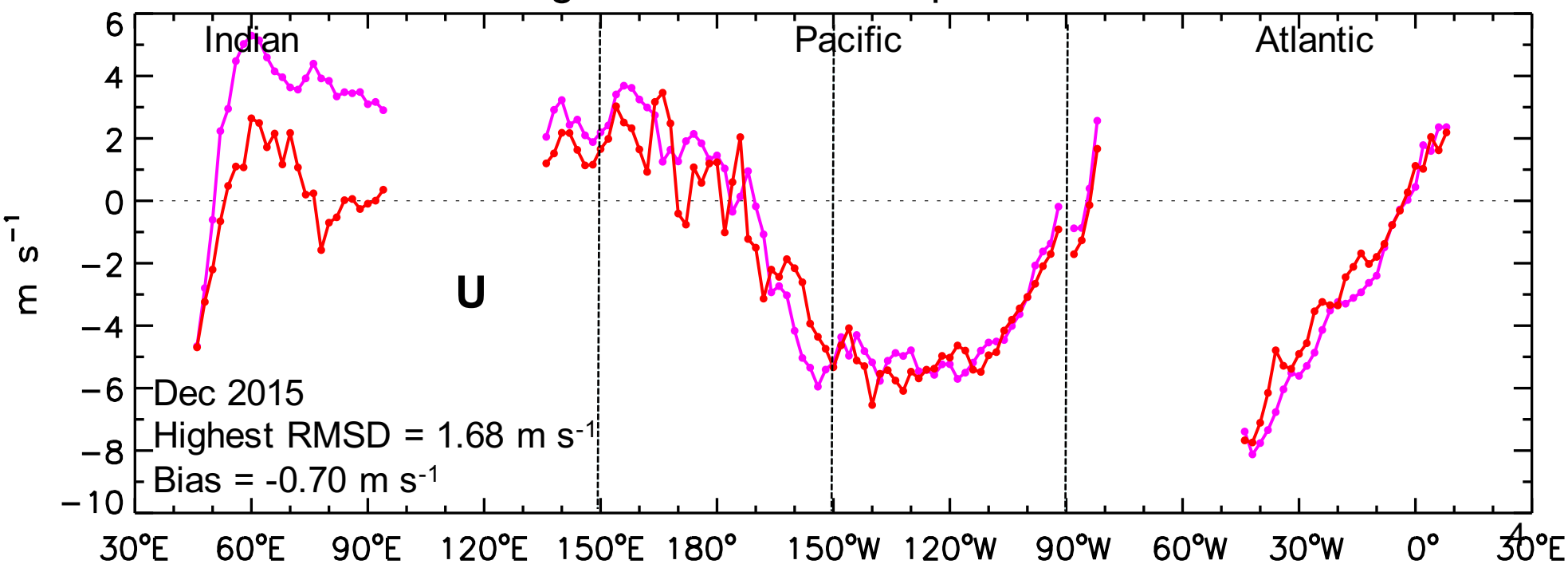
RSS V1.2 Data

$<\triangle U_{A\text{-}R}> = -0.35 \text{ m s}^{-1}$

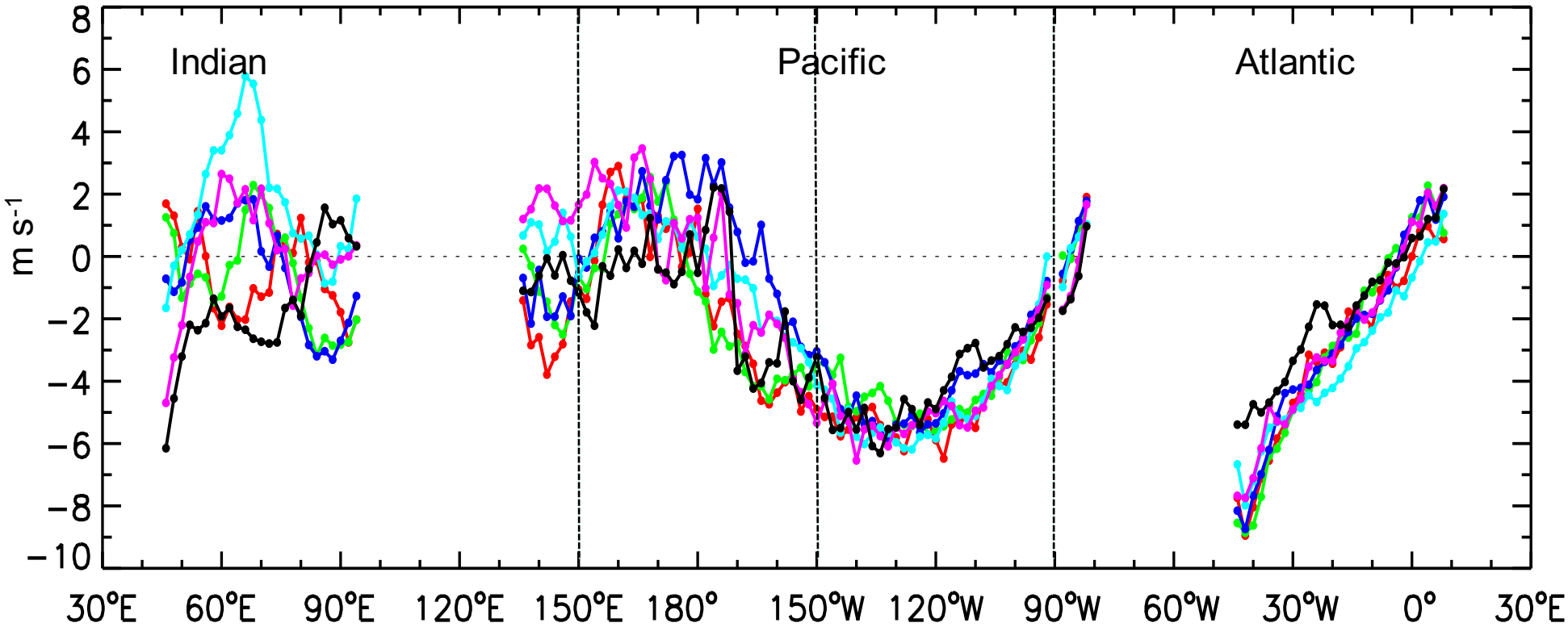
$<\text{RMSD}> = 1.11 \text{ m s}^{-1}$

PODAAC V1.1 Data

2°x2° grid centered on equator



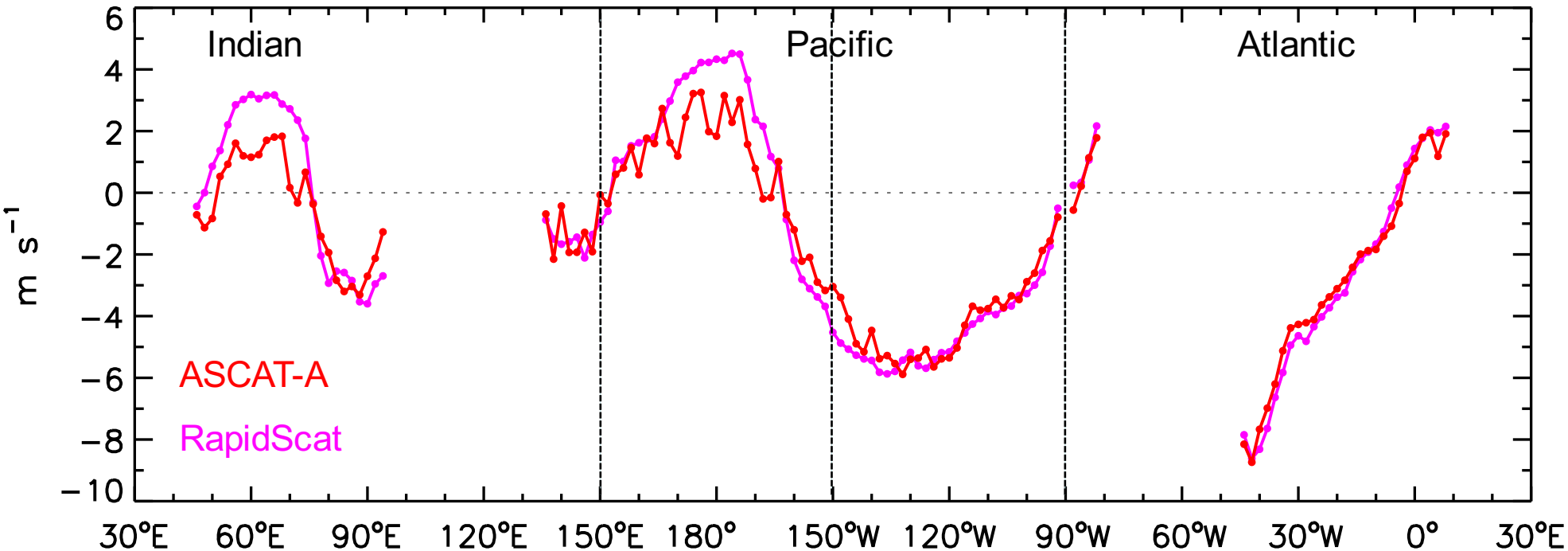
ASCAT-A Monthly Surface Zonal Wind Speed Aug 2015 – Jan 2016



ASCATa 10 m Aug2015
ASCATa 10 m Sep2015
ASCATa 10 m Oct2015
ASCATa 10 m Nov2015
ASCATa 10 m Dec2015
ASCATa 10 m Jan2016

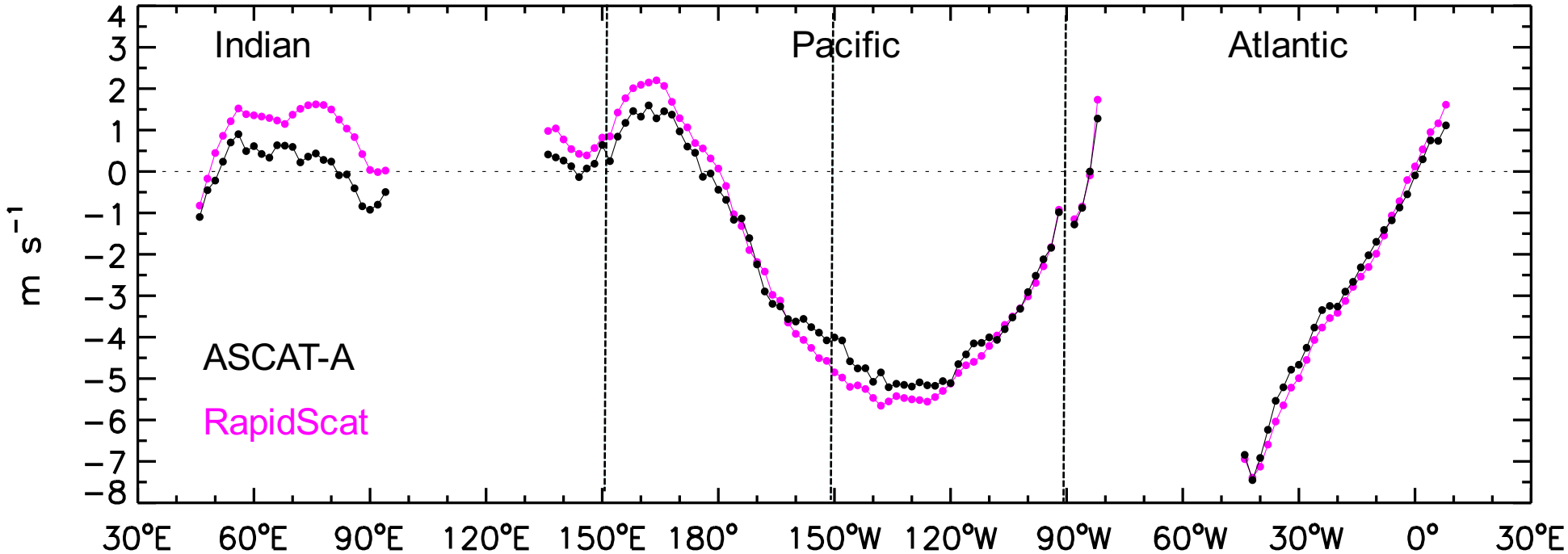
- Central Pacific, 170˚E – 150˚W
  - Weakest westward wind occurred in October

Surface Zonal Wind Speed in Oct 2015
Maximum Collapse Relative to 2015-2016 El Niño



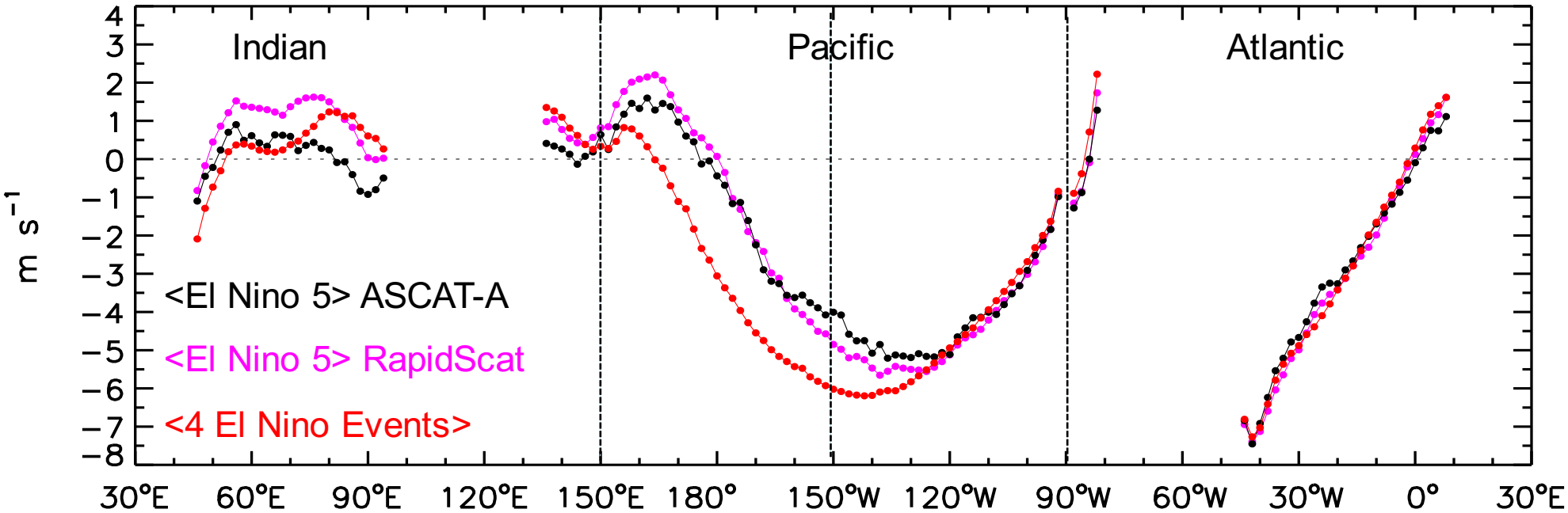
- ASCAT-A and RapidScat measurements both showed that eastward wind speeds extended eastward to 165˚W
- RapidScat eastward wind speeds in 170˚E – 170˚W (L = 20˚) were larger than ASCAT-A by 1.0 – 1.5 m s^{-1}
- From 50˚E – 70˚E (L = 20˚), RapidScat eastward wind speeds were greater than ASCAT-A by 1.0 – 1.5 m s^{-1}

Surface Zonal Wind Speed
Mar 2015 – Jan 2016 (super El Niño)



- At 155˚E – 165˚E (L = 10˚), 11-month mean RapidScat eastward wind speeds were larger than ASCAT-A by 0.5 m s^{-1}
- From 60˚E – 95˚E (L = 35˚), 11-month mean RapidScat eastward wind speeds were larger than ASCAT-A by 0.5 – 1.0 m s^{-1}

Summary



- Indian Ocean: Low correspondence between ASCAT-A and RapidScat wind of super El Niño and <4 El Niño>
- Pacific Ocean: Good correspondence between ASCAT-A and RapidScat with shape of <4 El Niño> longitudinal distribution
- Atlantic Ocean: Excellent agreement between ASCAT-A, RapidScat and <4 El Niño> longitudinal distributions

ASCAT-A and RapidScat extend QuikSCAT dataset