Investigating Intense Non-Convective Wind Events:

Using NASA Earth Observations to Improve

Forecasts of Small-scale Wind Events

by

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OPENING SHOT SHOWING TITLE SLIDE WITH PROJECT TITLE

MICHELLE: Hello, my name is Michelle Hogenmiller,

NICHOLAS: and this is Nicholas Elmer,

MICHELLE: and we are senior meteorology majors and members of the Saint Louis University team for the Summer 2012 NASA DEVELOP Applied Sciences National Program. Saint Louis University is a new location for the NASA DEVELOP Program this year, and our Summer 2012 research project is titled: Investigating Intense Non-Convective Wind events.

SLU TEAM PICTURE SHOWN

MICHELLE: The research team at Saint Louis University includes four Saint Louis university students: Nicholas, myself, Master's student Sarah Trojniak, and Master's student Mallory Cato. We worked under the guidance of our science advisors, Dr. Emily Berndt and Dr. Timothy Eichler.

PHOTO OF WAVES OVER GREAT LAKES

MICHELLE: Localized wind damage, resulting from non-convective high wind events, is one of the most difficult aspects of weather to forecast.

PHOTO OF UK STORM DAMAGE (OVERTURNED TRUCK)

MICHELLE: They have a large socio-economic impact, from downed power lines and trees to disrupted shipping routes and even loss of life.

PHOTO OF UK STORM DAMAGE (FALLEN TREES)

MICHELLE: Our goal is to create a forecast tool that diagnoses the connection between stratospheric intrusions and near-surface non-convective winds, which can be assimilated into the new set of operational products under development by the GOES-R Proving Ground.

PHOTO OF UK STORM DAMAGE (FALLEN BRICKS)

NICHOLAS: Since stratospheric intrusions are linked to non-convective high winds, we are utilizing NASA's Red, Green, and Blue Airmass Product (RGB) to identify these features.

PHOTO OF UK STORM DAMAGE (FALLEN TREE AND SMASHED CAR)

NICHOLAS: We are also using NASA's Modern Era Retrospective-Analysis for Research and Applications, also known as MERRA data, in conjunction with the RGB product to identify areas of non-convective high winds.

POWERPOINT SLIDE SHOWING PROJECT PARTNERS AND LOGOS

MICHELLE: During this project, we worked with the GOES-R Proving Ground, which is a joint project of NOAA and NASA, who will use our research results and analysis of the RGB Air Mass product to provide improved forecasts of non-convective high wind events. We are also working with NASA SPoRT, whose function is to transition observations and research capabilities to the operational weather community to improve regional short-term forecasts.

POWERPOINT SLIDE SHOWING MAPS OF STUDY AREAS

NICHOLAS: Using satellite and reanalysis products, we have completed a synoptic and diagnostic analysis of three case studies exhibiting these strong surface winds: the October 26, 2010 cyclone which impacted the Midwest and Great Lakes regions of the U.S., the October 30, 2011 cyclone which affected New England, and the January 3, 2012 cyclone which impacted the United Kingdom.

POWERPOINT SLIDE SHOWING LOGOS OF SATELLITE DATA UTILIZED IN PROJECT

MICHELLE: We collaborated with the GOES-R Proving Ground and NASA SPoRT to assess how GOES-R Air Mass imagery, MODIS, and AIRS products can be linked with NASA EOS satellite products to improve the ability to forecast these events. We used NASA’s MERRA data to verify synoptic scale features seen in the NASA satellite products. We utilized MODIS, which is on board the AQUA and Terra satellites, SEVERI, which is on board the METEOSAT-9 satellite, and GOES-11 and GOES-13 visible, infrared, and water vapor imagery.

WATER VAPOR AND RGB AIR MASS COMPARISON SLIDE

MICHELLE: When GOES-R is operational in 3 years, meteorologists will have access to NOAA/NASA RGB Air Mass product, similar to the SEVERI product on the METEOSAT-9, which will be a great improvement over the conventional satellite channels. The RGB Air Mass product will allow for a more accurate analysis, since it shows dry air more clearly and can relate the air to other properties, such as moisture and relative temperature.

RGB AIR MASS TIME-LAPSE VIDEO OF OCT. 26, 2010 STORM

NICHOLAS: An RGB product created from the AQUA and TERRA MODIS was used in our analysis, although the spatial and temporal resolution is much lower than the RGB Air Mass product which will be on board GOES-R. Using the MODIS RGB product, we were able to analyze the three case studies and determine whether a stratospheric intrusion played a role in the cyclones' development.

MERRA OZONE AND PV TIME-LAPSE ANIMATED .GIF IMAGE

NICHOLAS: We used MERRA reanalysis to verify the features seen in the RGB Air Mass imagery. This allowed us to more easily link the high concentrations of ozone to upper level potential vorticity.

MERRA SURFACE WIND TIME-LAPSE ANIMATED .GIF IMAGE

MICHELLE: Surface wind plots created from the MERRA reanalysis provided the most essential link between the stratospheric intrusions and the high surface wind gusts within the dry intrusion.

POWERPOINT SLIDE SHOWIG COMPOSITE HYSPLIT MODEL

NICHOLAS: NOAA ARL Hysplit was used to model the locations of the conveyor belts and verify that the dry conveyor belt was linked to the red regions in the RGB Air Mass imagery.

POWERPOINT SLIDE SHOWING DRY CONVEYOR BELT MADE FROM HYSPLIT

NICHOLAS: Although the composite images failed to show that the dry conveyor belt descended, the individual dry conveyor belt forward trajectory analysis did show that the dry air descended below 700 mb. The Hysplit models not only verified that the conveyor belts could be identified solely using the RGB Air Mass imagery, but also verified that the dry conveyor belt descended towards the surface.

RGB AND AIRS OZONE CONCLUSION POWERPOINT SLIDE

MICHELLE: Linking these multiple products together verifies the usefulness of the RGB Air Mass product. Most importantly, we confirmed that stratospheric air associated with the dry conveyor belt can be identified on the RGB Air Mass imagery by the red and orange colors.

MERRA AND RGB POWERPOINT CONCLUSION SLIDE

MICHELLE: Additionally, a comparison of the 925 mb and 300 mb MERRA reanalysis with the RGB Air Mass imagery reveals a correlation between the dry conveyor belt and strongest near surface winds.

POWERPOINT SLIDE SHOWING ACKNOWLEDGEMENTS

MICHELLE: We would like to thank Dr. Emily Berndt, Dr. Timothy Eichler, and Dr. Jack Fishman at Saint Louis University for advising us throughout this project. We would also like to thank Dr. Michael Folmer with GOES-R Proving Ground and John Knaff of NOAA/NESDIS/STAR for providing us with GOES-R RGB Air Mass imagery as well as the training to properly use the product.

NICHOLAS: Lastly we wish to acknowledge the team at NASA SPoRT for their assistanceThey worked hard to speedily generate MODIS Air Mass imagery and AIRS imagery for the project.

CLOSING SLIDE: IMAGE OF VISIBLE SATELLITE IMAGERY FOR OCTOBER 26, 2010 STORM WITH CREDITS

MICHELLE: This concludes our Summer 2012 DEVELOP Project at Saint Louis University. Thanks for watching!