DEVELOPMENT OF AN OPERATIONAL SAR SYSTEM FOR GEOPHYSICAL MEASUREMENTS: WIND FIELDS AS A FIRST CASE

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1. INTRODUCTION

Over the past decade, the Johns Hopkins Applied Physics Laboratory (JHU/APL) with the National Oceanographic and Atmospheric Administration (NOAA) has been converting synthetic aperture radar (SAR) imagery from virtually all modern spaceborne SAR systems into high-resolution wind speed imagery. The APL/NOAA SAR Wind Retrieval System (ANSWRS) is an outgrowth of the Alaska SAR Demonstration Project [1]. It has demonstrated wind retrievals from the Radarsat-1 SAR and other sensors in near real time, with resolutions better than 1 km and wind speed accuracy better than 2.0 m/s when compared to buoys and QuikSCAT measurements [2, 3]. Based on this ongoing success, NOAA has decided to implement ANSWRS in a fully-operational context. This affords us the opportunity to re-form ANSWRS into a system that is not only more reliable and easier to maintain, but a system that can be extended to other geophysical SAR measurements, from ocean wave spectra, to oil spill monitoring, to ship detection, by the addition of new modules. This paper describes the approach we take and progress achieved thus far.

2. THE BACKBONE APPROACH

The current implementation of ANSWRS system grew out of research project to determine how well wind fields could be retrieved off the coast of Alaska. As new SAR satellites and different wind retrieval algorithms were developed, they had to be introduced into a complex set of code. Unfortunately, there was only one path through the processing, making ANSWRS difficult to expand and intermediate products difficult to test and produce without code modification. We describe here the open architecture of a new ANSWRS system that minimizes the problem of adding data from new satellites, new algorithms, and new geophysical measurements.

The "backbone" approach relies on the creation of intermediate products that are all saved and shared on an Internet backbone. Such an approach is diagramed in Figure 1.The backbone could physically be a single disk drive or a complex set of cross-mounted drives depending upon the needs and capacity of any particular ANSWRS installation.

All SAR imagery from different satellites are converted into an identical format and stored on the backbone. The common format provides geo-location and SAR geometry values for each pixel as well as calibrated normalized radar cross section. In addition, a high-resolution land/sea mask is created. The land/sea mask for ANWRS is unique in that it represents land pixels as positive values and water pixels and negative values. The absolute value of the land/sea mask pixel represents the distance to the land/sea boundary. This allows subsequent analysis to make calculations and decisions based on the proximity to land.

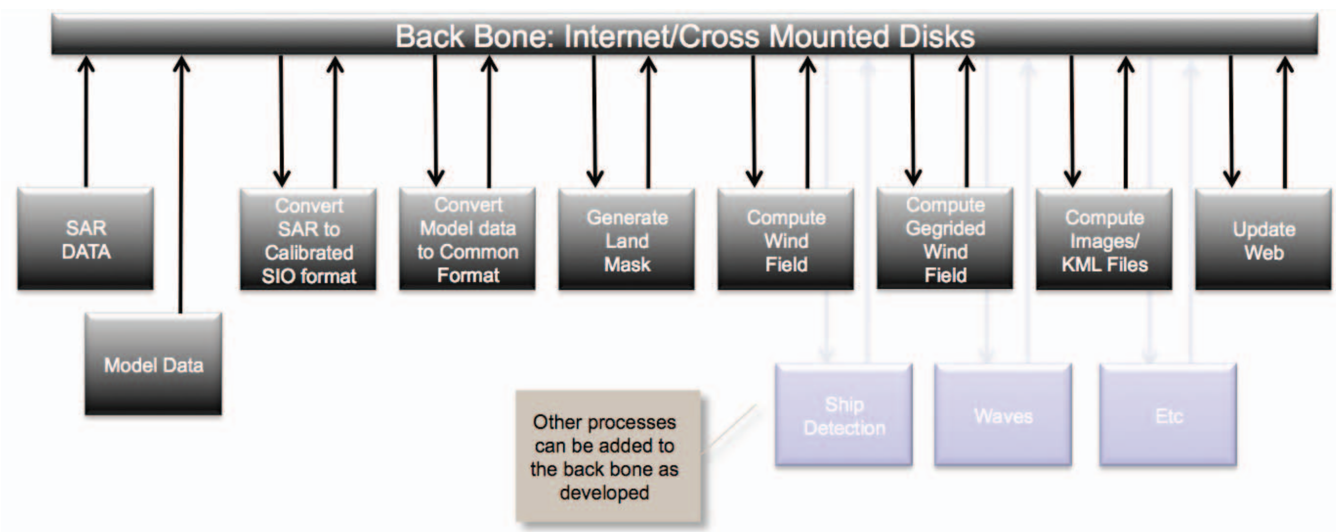

Figure 1. Backbone approach processing flow.

3. IMPLEMENTATION

This approach (ANSWRS 2.0) is currently be implemented by JHU/APL and NOAA. At this point, the frontend ingester for currently flying SAR systems from which we have data (Radarsat-2, ALOS PALSAR, Envisat, TerraSAR-X, and ERS-2 is complete and being tested. As new SARs instruments come on line, we need only add a new data "ingester," and all subsequent processing need not change. We plan to implement to wind processing module first.

All geophysical results are also stored on the backbone in a commonly defined format so that other geophysical measurement can be layered on top. For example, wind speed estimates would aid in the analysis of oil spill and in interpreting ship detection results. The current plan is for all geophysical output files to be stored in NetCDF format. Geophysical products will come in two flavors: sampled at the same resolution and geometry as the original SAR data (level 2) and averaged and sampled gridded to a rectilinear longitude-latitude (level 3). We note that storage of information on a backbone also allows additional SAR geophysical measurements to be computed with a variety of tools written in a variety of languages. The first geophysical product produced will be then familiar wind speed images.

The new architecture is designed with expansion, input data diversity, and processing tool diversity in mind. In this presentation, we will also describe current progress in the new ANSWRS implementation.

11. REFERENCES

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