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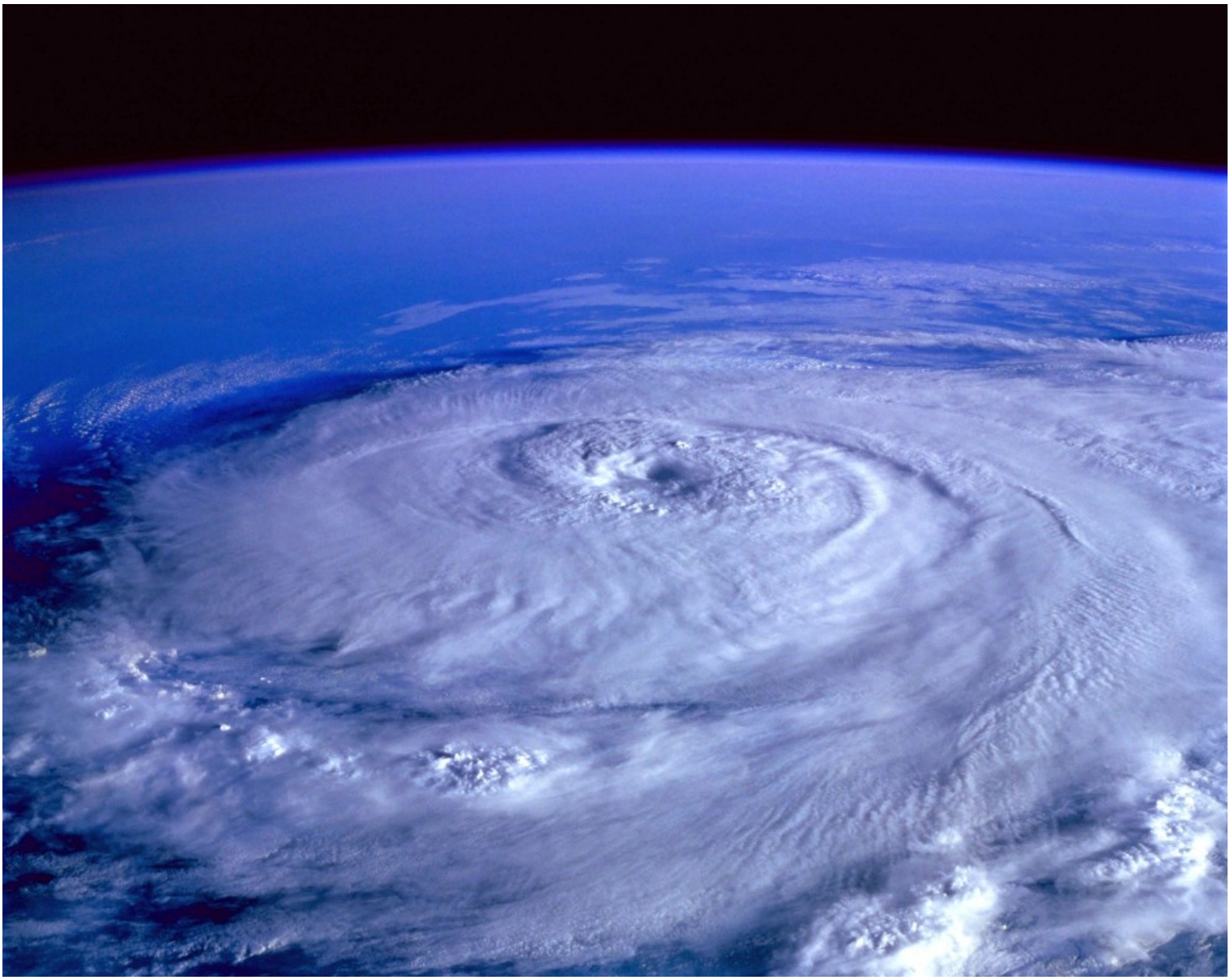

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[3] Engineering in action: Water Measurement for the 21st century and a new

approach to Programming

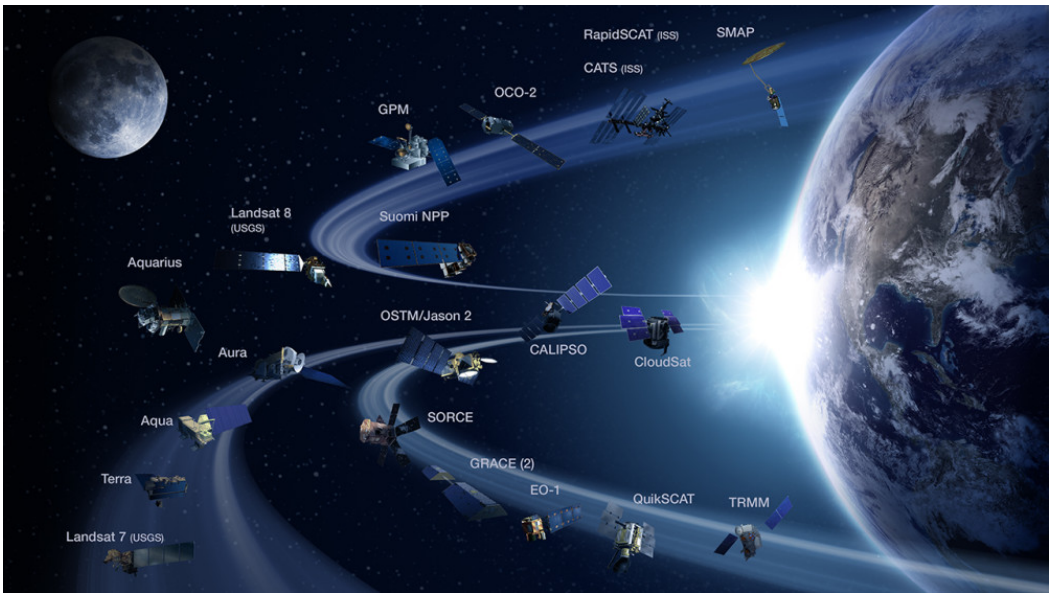
As part of our ongoing series showcasing the research our professors are working on, in this installment we will be presenting the research of Dr. Salem Ibrahim Salem and Dr. Ian Piumarta. Dr. Salem is working on the water measuring technologies, while Dr. Piumarta is focusing on meta-programming.

Water Measurement for the 21st century

Water is essential to all lifeforms, and monitoring of water resources is very critical to ensure their sustainability. Dr. Salem has been working on improving the accuracy of monitoring.

There are a variety of approaches in this field: the main methods are using satellite data and conducting field measurement. Field measurement produces very accurate data but is very time consuming and does not provide the condition for a whole body of water. Satellite data allows long-term, daily recording, but satellite only measure reflective sunlight and not water quality data such as the concentration of water. A combination of these approaches is how Dr. Salem usually obtains his data, but recently advancements in drones have resulted in new potential. As in other fields of measurement, drones have the potential to change how we measure water

dramatically. Drones fly much closer to the water than satellites, but do not necessarily need the manpower and resources required for field measurement. With drones, high resolution images can be obtained for large bodies of water at higher efficiency than ever before – especially if improvements in flying time (i.e. battery life) and camera functionality to include hyper-spectral cameras come to fruition.



How does Dr. Salem's research contribute to our understanding of water? The first application that comes to mind is weather: water analysis helps make weather reports more accurate, and on a global scale. This goes beyond tomorrow's forecast to include predictions for extreme weather such as floods, crucially important as such events have become more common in our changing climate. Further applications can benefit people whose livelihoods directly depends on bodies of water, such as fisherman. In developing nations, there is even higher demand, as the need for clean water (and thus the analysis of toxicity in water) is crucially important. Dr. Salem has gathered data in Vietnam, Thailand, the East China Sea and Tokyo Bay, and is looking to continue his research to help understand the most crucial element to human life.

A new approach to Programming

Dr. Piumarta began programming at the age of 10 on a Texas Instruments programmable calculator, and his passion for computers has driven him to live in three continents as the advancements in computer technology have shaped almost every detail of our modern life. He has also been interested in how we interact with computers, and one of his greatest research goals is to fundamentally simplify this interaction.

He has previously been working on scaling down source code, proving that it is possible to render complex operations in just a few lines of code. Using this knowledge as a base, he is looking to make our programming languages “intelligent”, coming up with more elegant ways to model and express solutions to problems, making programs less complex, easier to reason about, and ultimately more reliable. Specifically, this field is called meta-programming, which allows a programming system to have knowledge of itself or to modify its own characteristics. Any system that can observe and analyze its own behavior, and can adapt itself to changing conditions, has the potential to improve performance or reduce resource requirements. Take communication in the Internet of Things (IoT), for instance, which uses protocols that can be complex to implement and yet easy to describe with the help of the right models and ways to express behavior that themselves can evolve easily in parallel with our understanding of the problem.

Using this, Dr. Piumarta wants to take on the “programming crisis” – he believes that it is still way too hard to make a program do what you want it too, and he wants to bring this flexibility into the mainstream. If he were able to achieve this, one could say that his research would have come full-circle. Furthermore, he sees further applications, specifically through applying such software parameters to the hardware side. With more and more devices becoming “smart” as part of the Internet of Things, this could have profound implications. One potential application would thus be self-modifying hardware, which is able to configure itself based on what external factors require. Starting with his calculator that had mere 2 kilobytes of ram, Dr. Piumarta has taken his passion into a fascinating career, and we are excited to see how he will look to revolutionize programming from here on out.

The Kyoto University of Advanced Science’s (KUAS) all-new, innovative English-taught engineering department is currently in the planning phase for its launch in 2020. The school itself has a 50-year history since its establishment, and is an accredited private institution located in the heart of Japan. By inviting the top-notch CEO of a Kyoto-based globally successful firm as chairman, the university aims to offer its academic resources in the international arena, with the exciting new engineering department being one example of these efforts.