Abstract:
A general assumption allowing Synthetic Aperture Radar (SAR) imaging is that the observed scene does not change during the aperture time. This limitation is generally acceptable for the observation of land. In contrast, it is clear that this assumption does not hold for the fast decorrelating ocean surface. One consequence is that the azimuth resolution becomes limited by the coherence time of the surface. However, for most applications the reduced resolution is not a problem, since the desired products are usually relatively low resolution products, which are usually achievable, and the much finer nominal resolution can still be exploited to generate large numbers of independent looks. A stronger limitation becomes apparent when SAR observations are compared to radar observations made by fixed coastal radars. Indeed, those allow the observation of the spatio-temporal statistics of the radar echoes, for example in the form of the spatially varying Doppler spectra.

In this presentation a novel radar imaging technique, which we call Correlating SAR (CoSAR), will be discussed. The basic idea is to operate two physically separated radars (which may share a common transmitter) with a relative motion so that their azimuth (cross-range) separation varies with time. Pairs of echoes acquired at each instant of time and relative position can be combined to produce estimates of the spatial autocorrelation function of the received signal. Estimates of this autocorrelation function for different positions can then be combined to high resolution images of some statistical properties of the scene, including estimates of the space-varying Doppler spectrum. This approach to imaging, which follows from the Van Cittert-Zernike Theorem, is used, for example, in synthetic aperture radiometers.
In particular, we are interested in a CoSAR system consisting of two geosynchronous spacecraft with a relative motion around a nominal geostationary position. Such a configuration would allow the observation of the ocean surface at moderate resolution, with regional coverage, and high temporal sampling (two observations per day). Besides allowing the estimation of the Doppler spectrum of the surface, the configuration discussed will also yield a cross-track interferometric phase, from which ocean topography could be derived. The resulting observational capabilities of the ocean surface would be unique in terms of the temporal and spatial sampling, the nature of the measurement (short-time averaged Doppler spectra), and the range of geophysical quantities simultaneously addressed (surface wind, surface currents and mean surface height).

In the presentation we will introduce the basic concept, discuss the expected performance, and outline a mission scenario.

Bio:
Paco López-Dekker was born in Nijmegen, The Netherlands, in 1972. He received the Ingeniero degree in telecommunication engineering from Universitat Politècnica de Catalunya (UPC), Barcelona, Spain, in 1997, the M.S. degree in electrical and computer engineering from the University of California, Irvine, CA, USA, in 1998, under the Balsells Fellowship, and the Ph.D. degree from the University of Massachusetts, Amherst, MA, USA, in 2003, for his research on clear-air imaging radar systems to study the atmospheric boundary layer.

From 1999 to 2003, he was with the Microwave Remote Sensing Laboratory, University of Massachusetts. In 2003, he was with Starlab, Barcelona, where he worked on the development of GNSS-R sensors. From 2004 to 2006, he was a Visiting Professor with the Department of Telecommunications and Systems Engineering, Universitat Autonoma de Barcelona. In March 2006, he joined the Remote Sensing Laboratory, UPC, where he conducted research on bistatic synthetic aperture radar (SAR) under a five-year Ramon y Cajal Grant. At the university, he taught courses on signals and systems, signal processing, communications systems and radiation, and guided waves. Since November 2009, he has been leading the SAR Missions Group at the Microwaves and Radar Institute, German Aerospace Center, Wessling, Germany. His current research is focused on the study of future SAR missions and novel mission concepts.